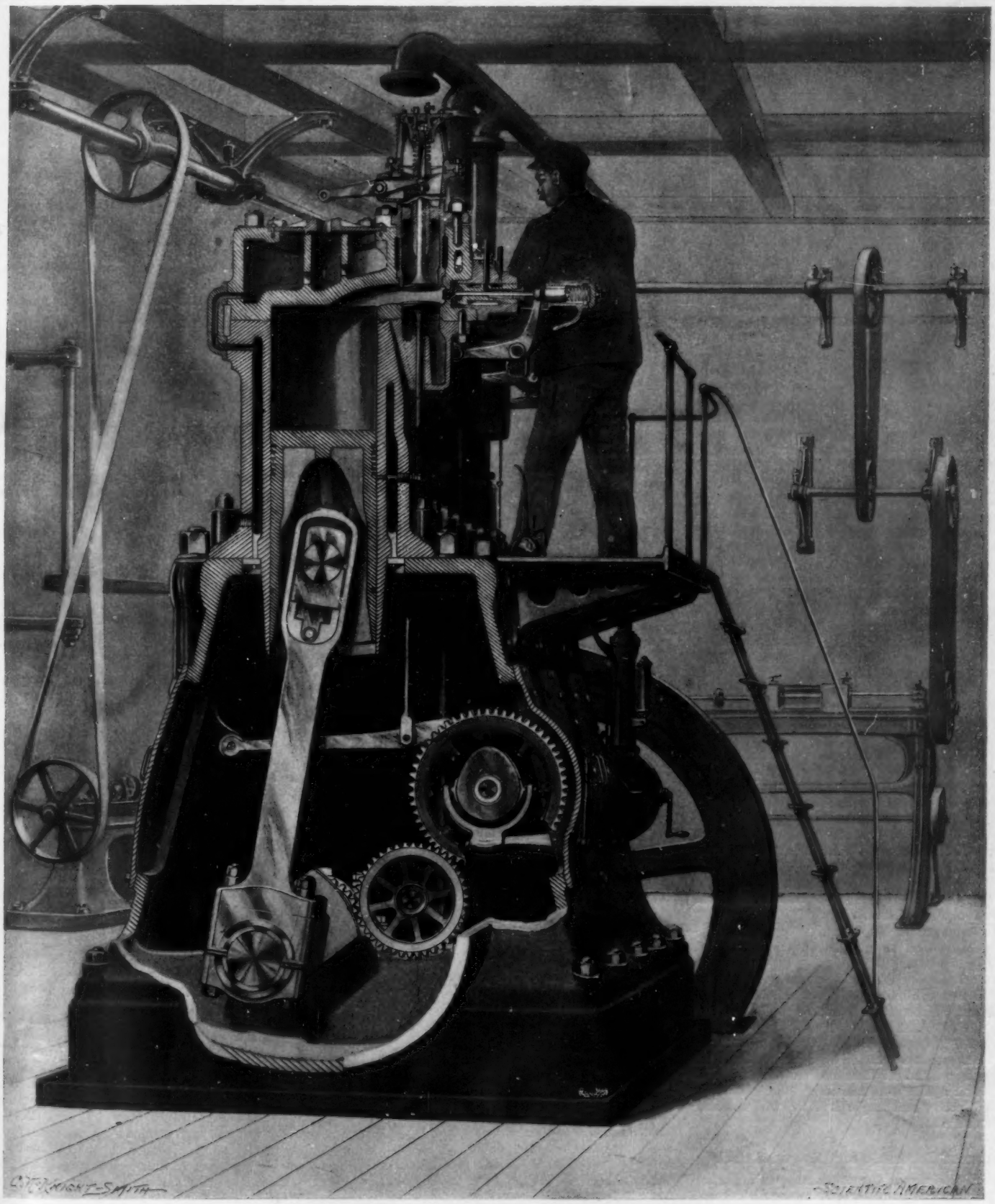
SIXTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CV. NUMBER 15.] NEW YORK, OCTOBER 7, 1911 [10 CENTS A COPY $3.00 A YEAR



A STATIONARY DIESEL ENGINE OF AMERICAN DESIGN

Engines of this type will consume only 0.38 pound of fuel per brake horse-power.—[See page 314.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, OCTOBER 7, 1911

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, Secretary and Treasurer; all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter

Copyright 1911 by Munn & Co., Inc.

Subscription Rates

Subscription one year $3.00

Postage prepaid in United States and possessions, Mexico, Cuba, and Panama

Subscriptions for Foreign Countries, one year, postage prepaid, 4.50

Subscriptions for Canada, one year, postage prepaid, ... 3.75

The Scientific American Publications

Scientific American (established 1845) . . . . . per year, $3.00

Scientific American Supplement (established 1876) . " " 5.00

American Homes and Gardens . . . . . " " 5.00

The combined subscription rates and rates to foreign countries, including Canada, will be furnished upon application.

Remit by postal or express money order, bank draft or check.

Munn & Co., Inc., 361 Broadway, New York

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The "Liberté" and the "Maine"

IT was inevitable that the destruction of the French battleship "Liberté" by the explosion of her magazines would revive in our minds the loss of the "Maine." Whatever the first cause, the results in each case were so identical, both in the loss of life and the complete destruction of the ship, as to make it certain that it was the letting loose of the enormous energy stored in the powder magazines that tore the two ships asunder and sent them swiftly to the bottom. At the present time it is hopeless to attempt to arrive at any satisfactory conclusion as to the ultimate cause of this horrible tragedy on the French ship. The dispatches contain the usual and inevitable mass of contradictory statements of eye witnesses and suggestions by experts. This, however, is certain, that among professional men in this country, both naval and military, there is a grave suspicion that there is something wrong with the French smokeless powders. With the similar accident to the "Iena" fresh in mind, this suspicion is unavoidable. We notice that one apparently official dispatch states that all smokeless powder is being landed from certain ships, and that some of this powder was manufactured as far back as 1902—a period which antedates by several years the "Iena" disaster.

On the other hand, if it be true that a fire started in the paint room and ran from there to the coal bunkers and magazines, the question will at once be asked, "What in the world is a paint room doing down below the protective deck and in contiguity to the magazines?" On the ships of our navy the paint room is located immediately under the forecastle deck and up in the very eyes of the ship at the bow. And if a fire that proved difficult to control did break out below the protective deck, why, it will be asked, were not the magazines immediately flooded? Perhaps the answer is to be found in a cabled dispatch, which states that the commander of one of the French ships who recently flooded his magazines on the outbreak of a fire received a reprimand on the ground that his action was too precipitate.

It is pathetic that the gifted people who gave to the world that smokeless powder which has revolutionized naval construction should themselves so frequently be the victims of their own invention. If the "Liberté" disaster leads to a thorough overhauling and reorganization of the French navy (and the unending list of naval disasters strongly suggests that such an upheaval is necessary) the loss of the "Liberté," costly and tragic as it is, will not have happened in vain.

Section of Battleship for Big-gun Attack

THE tendency of target practice, as far as appropriations will allow, is in the direction of substituting the actual ship and solid armor for the time-honored canvas screen—and this for obvious reasons. Although the canvas target serves admirably its purpose of showing the accuracy of gun-fire, it gives no indication whatever of the punishing effect of such shots as get home upon the mark. Hitherto we have depended almost entirely for such information upon the results obtained by firing at armor plate, set up at a proving ground and attacked by a gun a few hundred feet in front of the target, whose projectiles have been delivered with reduced powder charges, giving a low velocity, corresponding to that at which the projectiles in an actual engagement would reach the ship when fired at long ranges. A disadvantage of most proving-ground trials is that the projectiles strike the plate normally to its face, and therefore under the best conditions for penetration, whereas in an engagement, carried out at ranges of from eight thousand to twelve thousand yards, the shells will be descending at an angle of from seven to ten or more degrees.

Our ordnance officers have always recognized these facts, and it is only recently that a liberal policy and more generous appropriations have enabled them to test the resistance of the armor and the ship under conditions at least approximating those of the future sea fight. Our readers will have in mind the "Katahdin" experiments, when heavy armor plate which had been erected on this obsolete vessel was attacked by a 12-inch gun, at ranges of 8,000 yards and up. Even more valuable in the information gained was the famous target practice against the "San Marcos," formerly the "Texas." Here the test was of the resisting power, not only of the armor, but of the whole ship itself, to modern gun attack.

It is necessary to take but one step further to give the navy absolute information on this subject, and this would be to sacrifice one of our modern ships, carrying the latest armor, backed up by the most approved methods of interior reinforcement and subdivision, by mooring her in Chesapeake Bay and permitting one of our latest ships to subject her to a bombardment similar to that which tore the "San Marcos" to pieces and quickly sent her to the bottom. But not even the information of priceless value which could be thus secured would warrant so costly an experiment.

There is, however, a cheaper way to secure the desired information. That is by building a floating structure of limited displacement, representing an exact section of a modern battleship, whose behavior under gun attack would be sufficiently similar to that of the ship itself to afford our naval constructors and ordnance officers a large amount of greatly needed information. Now, it is exceedingly gratifying to learn that there has been constructed at the Norfolk Navy Yard an experimental caisson which represents a battleship on one side and a cruiser on the other.

The caisson is being subjected to attack by guns, big and little, at ranges corresponding to those which may obtain in the various stages of a hard-fought naval engagement. In the present case, there is no such wholesale bombardment as marked the spectacular destruction of the "San Marcos." That sham battle was carried on mainly as a test of the accuracy of our modern system of correcting the range by spotting the fall of the shots. The tearing of the old ship to pieces was a foregone conclusion. Outside of the fact that it lent a touch of realism for the officers and men, and provided no end of stimulating "copy" for the press of the country, the lessons of the bombardment were necessarily, because of the great age of the ship, of limited value.

In the attacks on the caisson, however, we venture to state that after every single successful hit, the structure will be visited by officers of the line and staff, who will take careful count by photograph, and sketch and note book, of every detail of the damage inflicted. Each hit will have its own story to tell; and thus by alternate attack and inspection, round by round, our navy will lay in a store of practical information, the like of which, we venture to say, has never before been gathered by any navy in the world.

Foreign Students at German Universities

THE fame of the German universities is such as to render it quite unnecessary to extol their praise or to recite at length the many virtues for which they are so deservedly held in universal esteem. A question which invites discussion, however, is the influence, both upon Germany and upon the other countries, which the steady migration of students from abroad to the German seats of learning, and their subsequent return to their home countries, must exert both on Germany and upon the world at large. There is something slightly humiliating in the thought that we—and we do not stand alone in this matter—must needs send some of our best students to Germany, so that they may there receive what our universities seem to be unable to give them. While we would not for a moment entertain the desire or hope that this flow of young American manhood to Germany should ever diminish, yet we may very well harbor the wish that the causes for it may in time change, and that there may be an equal inducement in days to come for German students to visit our schools. There can be little doubt that a certain kind of academic work receives more attention and appreciation in Europe than it does with us, and possibly the causes for this are so deeply ingrained in the American national character that they can never be removed. In that case, the future to which we must look forward is that in time our universities may develop their own special points of excellence, for which they will be sought out by students from abroad. To some extent this is, no doubt, the case even now. Those who have themselves imbibed a little of the spirit of the old-world devotion to scientific investigation and to the study of art and literature, will, we think, hardly be quite satisfied with such a programme. Only the future can show just what course events will take.

Much more might be said on this side of the question, the influence of foreign studies upon our own country. There is, however, another aspect to the situation, which has recently been discussed in the pages of the *Zeitschrift für angewandte Chemie* by J. Bronn, namely, the effect which the extensive visitation of German universities by foreign students must have upon Germany itself. There are those, among the Germans, who feel some entirely justifiable jealousy in seeing the citizens of other countries, sometimes not particularly friendly to Germany, reaping of the harvest sown specifically for Germans by Germans. That such feelings should be voiced is perfectly natural, but it is also quite obvious that they are framed from a rather narrow point of view, which is not only somewhat repellent, owing to its selfish ring, but in view of the failure to take into account certain factors, is probably entirely fallacious. And these factors assuredly far more than compensate for any losses which Germany may suffer in the way indicated. Mr. Bronn considers the effect of the attendance of foreigners at German universities, first upon the state, secondly upon German industries as a whole, and thirdly upon the chemical industry in particular.

As regards the first point he observes that Germany as a State does not enjoy very great popularity among other nations, and he points out that this fact cannot be viewed with indifference by a country which, like Germany, carries on extensive export trade. The young student arrives in Germany with a good stock of prejudice, and instead of mixing with the natives, as would be best for all concerned, prefers to keep aloof and frequent only the company of his own countrymen. It is usually not until after two or three years' sojourn that he begins to become acclimatized, and from this point on he learns to appreciate the good points of German character and German customs. He returns to his home country with his views radically changed, and takes every opportunity, if only in a spirit of contradiction, to sing the praises of Germany. The value to Germany of this kind of missionary work can not be estimated too highly.

Passing on to the discussion of the second point, namely, the effect upon Germany industry of an increase in the enrollment of foreigners at the German universities, Mr. Bronn remarks that such effect must be slight, for foreign students, practically without exception, return to their home country after the completion of their studies. There is, therefore, no question of competition by the stranger with the native for industrial positions.

On the other hand, the market for German products is most favorably influenced, for the man who has been trained in Germany will invariably give his first thought to German wares when considering the purchase of goods or machinery which cannot be procured in his own country.

Finally, as to the third point, the effect of foreign students upon the chemical industry of Germany, the same remark applies with regard to German exports in this field, as was made above with reference to German exports generally. The fear may be expressed that the graduate from a German university, upon settling down in his home country, will make use of the knowledge imbibed from German sources to place upon the market by home production the wares which until then had been imported from Germany. But as a matter of fact, every chemist knows that the mere university training, without experience in actual manufacture, is quite insufficient to enable a man to successfully establish a manufacturing installation on his own initiative, to say nothing of the very serious questions of capital, raw material, etc., which place severe obstacles in the path.

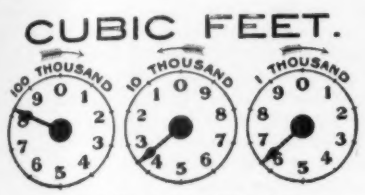


Fig. 1.—This reads 83,600 cubic feet.

The Meter

That Inexorable Mechanical Accountant of the Gas Company

Fig. 2.—This reads 88,900 cubic feet.

NINE-TENTHS of the distrust in which the gas meter is almost universally held is directly traceable to its obscure location in the dark, unpleasant surroundings of the cellar. We feel sure that the man who is loudest in his denunciation of this "instrument of extortion" makes no daily or even weekly trips down his cellar stairs for the purpose of verifying the totals footed up by the gas meter. If he did we are confident that much of his distrust would give way to respect. This same man may be most scrupulous about all his other accounts and would think it the height of absurdity to jot down his expenditures but once a month, with no memoranda to assist him in recalling the various items. Yet with ridiculous inconsistency he is ready to denounce any enlargement of the gas bill, forgetting that a whist party and a few friends to dinner or a succession of cloudy afternoons may have increased his gas-light hours—hours that are by no means overlooked by the mechanical accountant of the gas company.

However, we are not writing a defense of the gas meter. It is by no means a perfect instrument; hence the necessity of checking its records periodically. Unfortunately not one man in a thousand knows how to read a meter, yet there is no great mystery about it. Directions are published either on the back of the gas bill or on cards issued by the gas company, which may be had for the asking.

The meter is usually provided with three or four dials, each graduated in ten divisions. A small dial marked "Two feet" may be ignored for the present, as it is used only for testing purposes. The dial to the right is marked "1 thousand" and each of the divisions stands for 100 cubic feet, the entire circuit of the dial representing one thousand feet. On the next dial, marked "10 thousand," the hand moves in the opposite direction and each division stands for a thousand feet. In the same way each division of the dial marked "100 thousand" stands for ten thousand feet. Fig. 1 shows a simple example which will illustrate the method of reading. From this reading, the reading of the previous month is subtracted to show the amount of gas used in the interim. It should be noted that when a hand lies between two figures, the lesser number is read.

It is sometimes puzzling to know whether a hand lies on a figure or not, and this can be determined only by referring back to the dial on the right. For instance, if all three hands pointed to 9, we might carelessly put down the reading 99,900, which would be just 11,000 cubic feet out of the way. The true reading is 88,900, as a moment's consideration will show. The fact is made clearer by referring to the hands of a clock. When the hour hand of the clock points to X, and the minute hand to XI, we read not 10.55, but 9.55, because the minute hand shows us that the hour hand has not yet reached X. And so with the gas meter hands; the hand of the first dial shows that the hand of the second dial has not quite reached 9, although it may appear to be covering that number, while the hand of the second dial shows that the hand of the third one has not yet reached 9. It happens not infrequently that a meter inspector will make a mistake in such a reading, which may boost the gas bill considerably. Of course, the fault will right itself eventually, for at the end of the next month, there will be a larger subtrahend to deduct from the meter reading, and a correspondingly smaller bill. Sometimes an inspector, knowing about how much gas is used, will guess at the reading, if he finds it impossible or inconvenient to reach the meter when on his rounds, making his estimate low so as to be on the safe side. Then when he does make a *bona fide* reading, the gas bill will show a sudden rise, making up for the accumulated deficiencies of the inspector's low estimates.

In 1907, the Public Service Commission of the First District of New York took over the power and duties of State inspector of gas meters in Greater New York, since which time the citizens of this metropolis have been protected by all manner of safeguards against the possibility of fraud. All meters are carefully tested by the Commission and must bear its seal before being placed in a building. This seal indicates that the meter, when tested, was correct or not more than 2 per cent slow. A slow meter is one that does not register the full amount of gas passing through it, while a fast meter

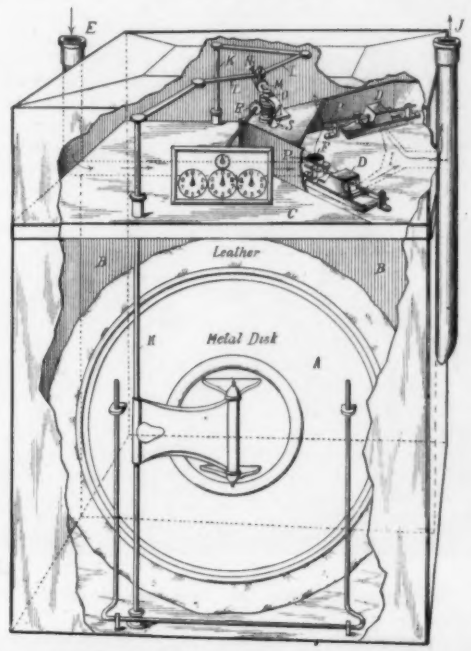


Fig. 3.—Interior details of a gas meter.

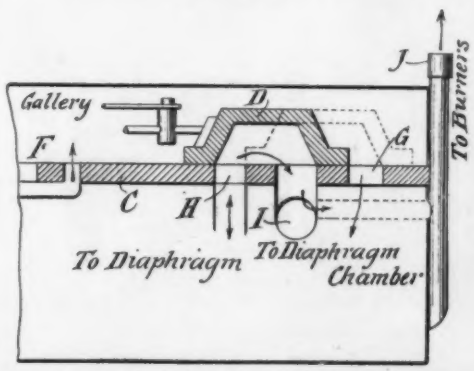


Fig. 4.—Section through one of the slide valves.

Reconstructing condemned meters.

THE METER

makes the consumer pay for more gas than he uses. No meter is allowed to be placed on a consumer's premises that runs at all fast, but if on a complaint a meter is not more than 2 per cent fast it is passed as correct. For the absurdly small fee of 50 cents (this applies to the smaller meters; for the larger meters from 20 to 300 lights and upward the charge is from 75 cents to $2.00), any one in New York can have his meter tested, and if the meter is found to be running more than 2 per cent fast, not only is the fee refunded and charged to the gas company, but the latter must make a settlement with the consumer for the unconsumed gas he has been paying for. From July, 1907, to July, 1911, 19,970 gas meters were tested on complaint; 45.8 per cent of these were found to be correct or within 2 per cent fast or slow; 10.3 per cent were found to be slow or running to the disadvantage of the gas company, while 43.9 per cent were fast. The variation of the meters averaged a very small figure, however, showing that the work of the meter itself was on the whole very creditable.

When a complaint is made to the Commission, a complaint inspector visits the consumer and makes a thorough inspection of his premises, searching for leaks. Occasionally a leak will be discovered near an open window or close to a chimney flue, where the draught will carry off the gas into the open, letting it escape undetected. Sometimes a jet is left burning in an attic or in some unused room, such as an amateur photographer's dark room, and the tenant comes back after a month or two of vacation to find a gas bill awaiting him. Not infrequently in apartment houses the meter is found to be connected with the wrong apartment and one man is then paying the other man's bills. Troubles of this sort account for the running of the gas meter when no gas is used. As a matter of fact, the meter can register nothing if no gas passes through it. When satisfied that there is no trouble with the pipes, the meter inspector seals and tags the meter and has it removed to the testing station.

The manner of testing the meter is simple. A measured quantity of air is passed through the meter, and the two-foot testing dial of the meter is noted, to see whether it registers this amount correctly. The prover in which the air or gas is contained is built just like a gasometer, consisting of a cylinder, with open bottom which telescopes within another cylinder filled with water to form a seal between the two. The inner cylinder is provided with a port which may be opened to admit air as it is raised. This port is then closed, sealing the air within as in a diving bell. The meter is now connected with the cylinder, and after care has been taken to make all the joints tight, the air is allowed to pass out through the meter. When two cubic feet of air have passed through, as indicated by the small dial, an indicator on the prover should show that two cubic feet of air have actually issued from the cylinder. If over two per cent plus or minus is indicated, the meter is rejected and must go to the repair shop. Usually, three readings are taken, and the average of the three determines the condition of the meter, this precaution being observed so as to do away with the personal equation, which might be a factor of serious importance if but a single reading were used.

If we follow the meter to the repair shop, we shall have a chance to investigate its interior construction and learn something of the ailments to which it is subject.

The drawing in Fig. 3 shows us how a meter would look if the front wall of the tin casing were torn off. Probably the first object to catch the eye would be the large circular bellows that occupies the lower part of the meter at *A*. There is another bellows of the same size and shape on the opposite side of the central vertical partition *B*. These bellows or "diaphragms," to use the technical name, consist of a ring of metal soldered to the partition *B* and connected by a strip of flexible leather to a metal disk. The diaphragms are the lungs of the

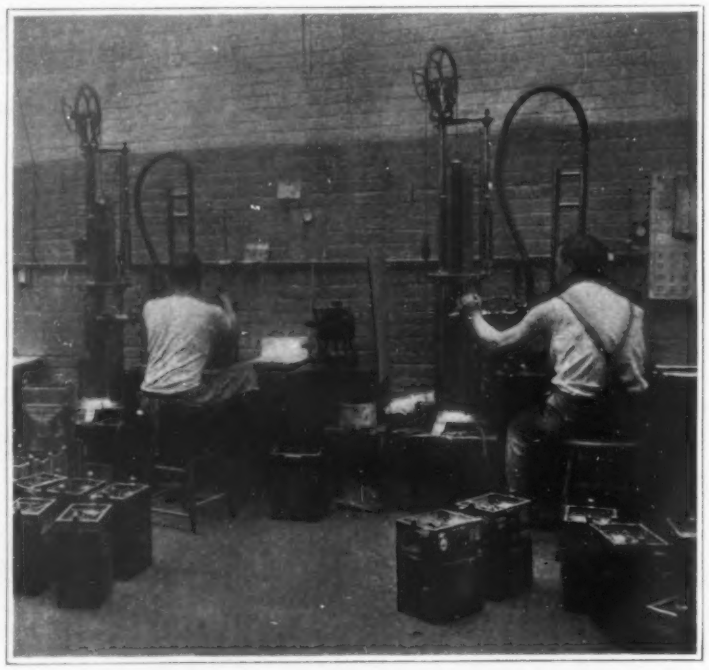
meter which inhale and exhale measured quantities of gas, while a counting mechanism is actuated by the heaving lungs, and indicates the count on the dials.

The counting mechanism is situated in the upper chamber or "gallery" formed by the horizontal partition *C*, and here also are the slide valves *D* that admit the gas to the diaphragms. A somewhat diagrammatic section through one of these valves is shown in Fig. 4. Gas enters the meter through the tube *E* and flows into the valve chamber through the port *F*. The valve port *G* leads to one of the diaphragm compartments, while the port *H* leads to the interior of the diaphragm in that compartment. The outlet port is shown at *I*, and it leads through pipe *J* to the burners in the house. The valve *D* is shaped to provide communication between the outlet port *I* and one or other of the ports *G* and *H* at all times, so that there is no interruption in the flow of gas out of the meter. With the valve in the position shown by full lines in Fig. 4, the gas is slowly filling the diaphragm chamber and flattening the diaphragm, which in turn is exhaling the gas it contains by way of the ports *H* and *I*. When the valve moves to the position shown by dotted lines, gas enters the diaphragms through port *H* and, as the diaphragm expands, under the pressure of the mains, it causes a proportionate amount of gas to flow out of the chamber through ports *G* and *I* to the outlet *J*. As there are two sets of diaphragms and valves operating in alternation, there is no appreciable variation in the pressure of the outflowing gas.

Each diaphragm is connected to a vertical rock shaft provided with a crank arm, and connected by a link *L* to a sleeve *M* adjustable on an arm *N* projecting from the valve shaft *O*. The combined motions of the rock shafts as they are oscillated by the inhaling and exhaling diaphragms, cause the valve shaft to rotate, and by means of connecting rods *P*, to operate the valves. By means of a worm and gear *R*, the counting mechanism is operated. The dog *S* serves to prevent the mechanism from running backward, and it is the action of the arm *N* striking this dog that produces the clicking noise which may plainly be heard when gas is flowing through the meter. Adjustment of the meter is provided by sliding the sleeve *M* in or out upon the crank arm *N*.

It is not very reassuring to the consumer to know that the majority of troubles that affect the gas meter tend to make it run fast rather than slow. As the parts become loose with wear there is a tendency for them to run faster, and as the leather bellows are saturated with moisture condensed from the gas, they shrink and deliver less gas at each aspiration. Sometimes so much water collects in the meter case that it seriously hinders the opening and closing of the bellows, and they operate only when partially filled. Here again the consumer loses.

There is another difficulty which should be considered, but which, however, can be overcome by a very simple device. Normally the pressure used in New York is "15 to 25 tenths," to use the trade expression, which is equivalent to about one-half to one pound water pressure, U or siphon gage measurement. If, for instance, the pressure should be increased to, say, 40 tenths, 50 per cent more gas would be consumed at the burner and, although there would be an increase in light, it would not be sufficient to compensate for the increase in the gas bill. On the other hand, the meter would not register the full amount of gas passing. There would be a loss of about 2 per cent, which the company would have to stand for. To obviate this trouble, a governor is provided, which may be placed upon the service pipe before it enters the meter. This will hold the pressure down to the normal limit. There was a period, from 1907 to 1909, when the pressure in New York was confined by law between the limits of 15 and 25 tenths. This limitation was finally withdrawn on the representation of the gas companies, who claimed that owing to friction when conducting gas over a long range, it is necessary to use a high initial pressure in order to maintain sufficient pressure at the end of the line. Still another factor to be considered is the elevation of the burner. The pressure at the crest of a hill is more than that in the valley below; on the ground floor of a skyscraper it would be much less than at the top. There is a difference of one-tenth pressure for every 14 feet of elevation, so that at the top of a 700-foot structure like the Metropolitan tower, twice as much gas would flow through a five-foot burner as at the street level. However, it is only in naked gas flames that there is a loss due to high pressure. Incandescent mantle lamps are self-governing and will consume only a fixed quantity of gas, while if the gas is used for cooking purposes there is no loss; for a rise in pressure will result in a corresponding rise in temperature.



Regulating meters that have been repaired.

Testing a complaint meter.

THE METER

The Burning of the German Military Dirigible "M III"

By Carl Dienstbach

THE crack dirigible of the Germany army, the semi-rigid "M III.," was partially destroyed by fire just before the end of the "Kaisermaneuvers," in which it had rendered valuable services on the "red" side.

The circumstances of this accident are interesting and instructive. The "M III." was of the Gross-Basenach German semi-rigid system, which differs from the original French semi-rigid Lebaudy system in separating the gas bag from the stiffening frame, making the latter part of the suspension, and dividing it into three separate sections better to withstand shocks in landing and facilitate dismantling. The envelope is similar to that of the Parseval system, having two ballonets fore and aft, with a distributing valve for the air between, to assist the vertical steering, which is done principally by shifting water with a pump between two tanks at the extremities of the combined stiffening frames. A seemingly slight, but as the accident has shown essential, defect was traced to the position of the blower for the ballonets. It is not carried in the car, but far above it, next to the frames, and driven by rope transmission to reduce the drag in the air of a long hose connection between car and envelope.

The "M III." displaced 240,000 cubic feet, had a length of 300 and a beam of 38 feet. The car was 40 feet long, and the distance between the bottom of the car and the top of the envelope stood 67 feet. The horse-power was 300, furnished by four Koerting motors, driving two propellers. The "M III." was equipped with wireless telegraph apparatus, and armed with apparatus for discharging explosives. In the maneuvers the whole crew of seven was furnished with rifles, kept in a special rack. Five of the crew were required to handle the ship, and two were observers. All but the engineers were army officers.

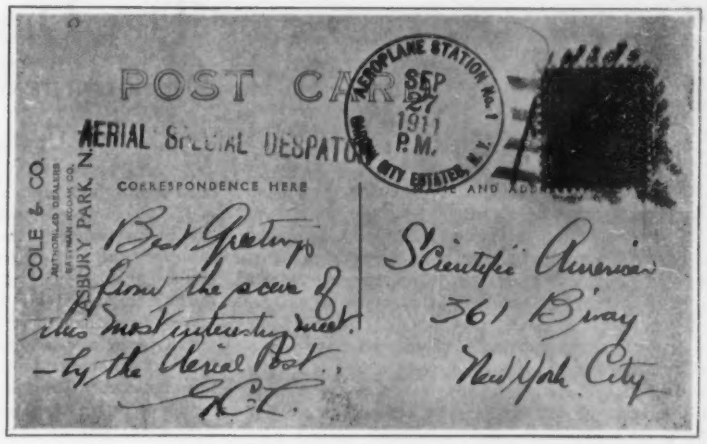
In this year's army maneuvers in Mecklenburg, Uckermark, and Pommerania, from September 7th to 14th, the "M III." had successfully performed all its alotted tasks, and, after ascending from Demming, Pommerania, in the morning of September 13th, was cruising in steady, certain flight over the villages of Golchen and Clempenow, when suddenly the rope transmission to the blower snapped. The gas bag began to lose its shape, and repairing in the air being not feasible on account of the blower's position, a landing became imperative. The dirigible was then drifting with useless motors toward a broad stretch of meadow on both banks of the Tollense River, a tributary of the Peene. From the air, in consequence of a well-known optical illusion, this meadow was apparently perfectly level and an excellent landing place. The pilot was evidently not an experienced airman, for he failed to recognize that the land formed a shallow valley, into and across which a lively "ground breeze" was sweeping

The descent, gentle at first, became suddenly very rapid when the airship caught in the descending current. The shock on striking the ground was quite violent. The ponderous envelope and framing continued to come down after the car had struck; fortunately, the wind carried it to the side of the car. From previous experiences with spherical balloons and investigations, it appears practically certain that the tremendous momentum of the heavy flabby mass of rubberized cloth of the gas bag and air ballonets, weighted with the framing and, in consequence of the quick descent, carrying a charge of atmospheric electricity, produced minute electric sparks through friction during this violent commotion; for the weather was very dry and hot. The shock at striking the ground also must have started leaks in the valves. The concussion instantly produced a certain quantity of explosive mixture of air and gas (normally the gas bag of a dirigible, unlike the envelope of a spherical, is hermetically sealed against the atmosphere by its safety valves), for there was a dull heavy report immediately after the envelope struck the ground, which shook the windows in the village of Gross below, and a column of flame shot up, which quickly consumed the gas bag with the planes, the framing, and the balky blower.

Fortunately, the crew could easily escape by jumping from the car on the opposite side, and the car with the motors and propellers was little harmed.

The accident is very instructive in showing how greatly the safety of a dirigible depends on the airmanship of the pilot, and that the facility to deflate and collapse, in place of being a guarantee of security, may, on the contrary, become a source of danger.

The aerial post office at Nassau Boulevard.



A card transmitted by aerial post.

Carrying Mail by Aeroplane

The First Experiments in this Country at the International Aviation Meet

ALTHOUGH the primal practical use of the aeroplane, as conceived by the Wright brothers, was for purposes of war, perhaps the regular carrying of mail will be the first actual use to which it will be put by our government.

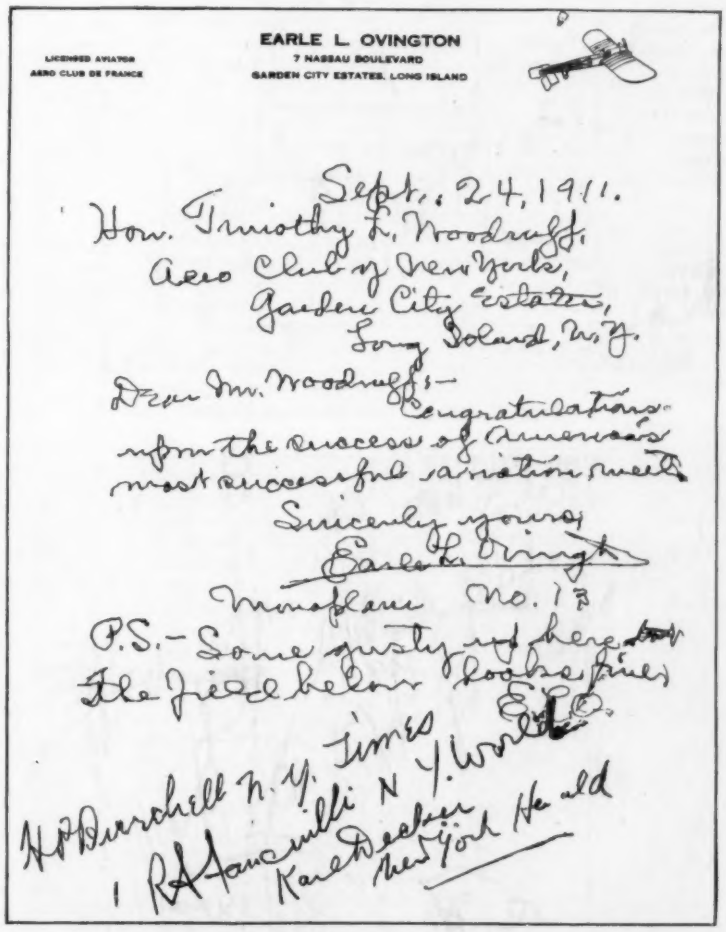
The first experiments in carrying mail were made by the British government in India last winter, when mail was carried from the Allahabad exposition grounds to a point several miles distant. Early in the present month, an aerial postal service was maintained for about a week between Hendon (near London) and Windsor Castle. This is a distance of some twenty miles. The mail was carried with more or less regularity by three machines—two biplanes and a monoplane, piloted by Driver, Hubert, and Greswell. The last named made the opening flight on his Blériot racer in a 25-mile wind, carrying letters sent by the King, Queen, and Postmaster-General to the Mikado and all the crowned heads of Europe.

On the opening day, 11,000 to 13,000 letters were carried, and all told, over 100,000 letters and postals were started on their way by the air route. It was in the maintaining of this mail service that Lieut. Cammell fell to his death. Strong winds delayed it on some of the days, but on the whole the service was maintained with commendable regularity.

When it was decided to hold an aviation meet at the Nassau Boulevard Aerodrome, one of the first features determined upon was an aerial postal service to Brooklyn. Postmaster-General Hitchcock authorized this service, and so interested was he that he personally carried the mail on the fourth day of the meet.

About a score of letter boxes were placed around at different parts of the grounds. These were labeled "Aerial U. S. Mail," and two collections were made each afternoon. The mail was taken to a special tent, where it was stamped and assorted and placed in small bags containing from ten to fifteen or twenty pounds. Instead of carrying the mail to the outskirts of Brooklyn, it was taken a few miles farther away from New York to Mineola and dropped in a field at the feet of the postmaster, who was on hand to receive it at the appointed hour.

Starting on Saturday, September 23rd, Earle L. Ovington, in his Blériot monoplane, made regular deliveries twice a day. On Sunday, the big day of the meet, there were 6,165 post-cards, 781 letters, and 55 pieces of printed matter to be transported. One bag weighing 14 pounds was carried by Ovington, while another, which weighed about 20 pounds, was given to Capt. Beck to be taken in his Curtiss biplane. Capt. Beck had trouble with his motor, however, and the heavy bag was carried by Tom Sopwith in his Wright. On Tuesday, when Postmaster-General Hitchcock himself carried the mail, the pouch which he dropped overboard at Mineola contained 162 letters and 1,400 postal cards, while the one carried by Ovington, who showed him the way, had 300 letters and 2,200 postal cards, besides 78 other pieces of printed matter.



The first letter written by an American pilot in the air. The shakiness of the writing is due to the vibration of the motor.

Copyright 1911 by Underwood & Underwood.

Postmaster-General Hitchcock seated in Capt. Beck's biplane with mailsack on his knees.

A demonstration of skillful airmanship was made by Mr. Ovington when he wrote a letter with a widely advertised fountain pen while aloft in his Blériot monoplane. Before ascending, Ovington gave a blank sheet of paper to representatives of three New York newspapers, who wrote their names upon it, so that they could identify it after the exploit and testify to the genuineness of the document. This letter is reproduced herewith, together with a postal card, which was sent by aerial post. Ovington was able to write, but once in a while, when the machine tipped sidewise, or tended to dive, his pen would slip slightly. The vibration of the motor caused the irregular writing shown in our reproduction of his letter; but the fact that he could write at all while flying a fast monoplane, shows the control which he had over his machine. He operated his warping mechanism and horizontal tail rudder with his left hand while writing.

It is to be hoped that the successful demonstration of mail-carrying that was given at the recent meet will cause the Postmaster-General further to consider the aeroplane for this use. It is quite possible to dispatch mail from New York to Boston, or to Philadelphia, and send it through without a stop. A gain of one or two hours could be made in the first instance, and the establishment of the service between New York and Philadelphia would make it possible to send a letter in the morning at the opening of the business day, and receive a reply early in the afternoon, whereupon a second letter could be forwarded and received before nightfall.

It is said arrangements are about to be made by transatlantic steamship companies for the special delivery of certain classes of foreign mail from the deck of the steamer, as it approaches the coast, to some station or locality in New York city by aeroplanes carried on the ship. By this means much quicker delivery could be effected.

Aeroplanes may yet be used for carrying messages or light life saving lines ashore from a stranded steamer when the distance from shore is beyond the range of the usual cannon.

The Diesel Engine

The Development of a Remarkable Motor

By Hayner H. Gordon

ANY one who has seen a large triple expansion marine engine in operation has been impressed with the mechanical beauty of the machine. Light and powerful yet easy running, with complicated structure yet mechancally simple, it appears as though this type of engine had at last reached perfection. And yet to-day it stands ready to be replaced by a new type of engine and motive power; a motive power that even a few years ago was largely ridiculed for its unreliability. The gas engine is conquering the land, has conquered the air, and is now beginning to claim the sea for its own.

All internal combustion engines are divisible into two general classes: those in which combustion takes place at constant volume, and those in which combustion takes place at constant pressure; the first being known as the Otto type and the second as the Brayton or Diesel type.

In order to make the difference between these two types clearer, it will be well to follow the cycle of operations in each case. In the Otto four-cycle engine, the piston on the first stroke down draws in the combustible mixture. The up stroke then takes place, compressing the charge to a pressure limited by the ignition temperature of the charge used. This is usually from 60 to 120 pounds per equare inch; at the top of this stroke the charge is ignited, and the piston is driven down by the pressure generated by the explosion of the charge. The fourth stroke then follows; the piston rising and the exhaust products passing out through the opened exhaust valve.

In the Diesel cycle the first stroke of the piston draws pure air into the cylinder; the piston then rises, compressing the air to a pressure of 500 or 600 pounds to the square inch, and thereby raising its temperature to about 500 deg. C. This high pressure is obtained by having very small clearance. At the top of the compression stroke an oil valve in the cylinder head is opened, and oil is forced into the cylinder in the form of a fine spray. This is at once ignited from the highly heated air, and continues to burn until the oil is cut off at about one-quarter to one-third of the down stroke of the piston. Expansion follows for the rest of the stroke, and the fourth stroke then takes place as in the Otto cycle.

In the two-cycle engines of either class, the piston uncovers ports at the end of its downward travel, the exhaust products passing out through one set of ports while the new charge is blown into the cylinder under slight pressure through the other ports. The charge of course consists of combustible mixture in the Otto engine, and air in the Diesel engine. Compression and working stroke then follow as in the case of the four-cycle engine.

Three points of superiority of the Diesel engine over the Otto engine will at once be noted. The first of these is the fact that there is no igniter present in the Diesel engine, and that therefore no ignition trouble can take place. Also there will be no trouble from pre-ignition, for there is no fuel in the cylinder during the up stroke of the piston.

The second point is that there is no carburetion or mixture troubles. In an engine of the Otto type, there is always a varying amount of exhaust products present in the mixture at various speeds which necessitates close regulation of the fuel supply. In the Diesel engine, the speed and power of the engine are entirely controlled by regulating the point in the working stroke at which the fuel is cut off. The last point in favor of the Diesel engine is the fact that the change in pressure is not violent as is the case in the Otto engine, but gradually increases during the compression stroke, reaching the maximum at the end of the stroke, and then remaining approximately constant until the fuel cut-off takes place.

The cylinders of the Diesel engine are of small bore with a long stroke. The pistons have to be well fitted in order to retain the high compression. Sometimes as many as ten piston rings are used for this purpose.

The fuels which may be used in the Diesel engine range from the lightest hydrocarbons to the heaviest crude oils. As the fuel must be entirely atomized upon entrance to the cylinder, we find a great many different types of valves for the different grades of oil. The valves are divisible, however, into two general classes: Those which make use of a fuel pump to force the fuel into the cylinder, and those which use compressed air to blow it in. Valves of the first type comprise a small passage through the cylinder head with a needle valve to adjust the nozzle or spray and which opens into the cylinder. Fuel is pumped to this spray valve by a small single acting plunger pump, at a pressure of 750 pounds per square inch, the length of stroke of the pump plunger being generally made adjustable, in order to time the admission of the fuel to the work of the engine.

The compressed air fuel admission valve is more largely used than the type just described. This valve usually consists of a hollow plug fitting in the cylinder head of the engine, and containing an inwardly opening check valve in the inner end. The hole in the center of this plug receives the charge of oil under a few pounds pressure, during the compression stroke of the engine, and then high pressure air at 750 pounds is admitted to the chambered plug, and the oil blown into the cylinder of the engine in the form of a fine

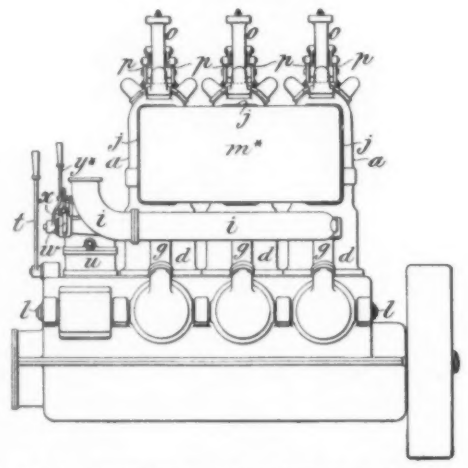


Fig. 1.—Reversing gear dependent upon changing position of cams relatively to the crank shaft.

spray. A valve of this type of course necessitates the use of a separate air compressor, but this is generally needed any way in order to furnish compressed air for starting the engine. In order to start the engine by compressed air, there is an auxiliary starting air inlet valve, which is operated from a cam on the camshaft to admit the high pressure air on a portion of the working stroke of the engine, thereby running it as an ordinary air engine. As soon as the engine picks up speed, the air valves are thrown out of operation by lifting the rockers off the cams or other equivalent method, and the engine picks up its regular cycle.

In addition to being equipped with self starting apparatus, the Diesel motor must also be made reversible, when used for marine purposes. In the case of low

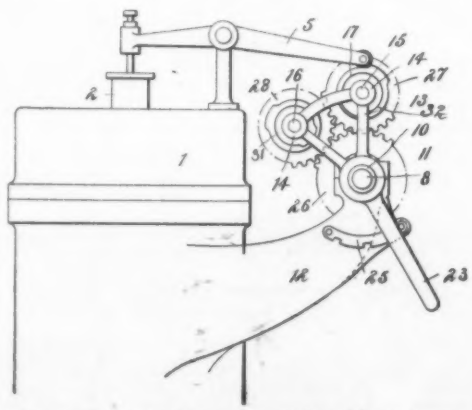


Fig. 2.—Reversing by means of two sets of cams, one for each direction of rotation.

power and small engines, it is possible to use either a reverse clutch or a reversible propeller, but such practice is impossible in engines of a thousand horsepower or over.

There are two methods employed in practice for reversing marine motors. The first is to change the angular position of the cams with respect to the crank shaft, and each other.

Fig. 1 shows a small Diesel marine engine employing this method of reversing. This engine possesses very unusual features in regard to the starting. It is of the two-cycle type, with exhaust ports controlled by the piston, and possesses an air compressing cylinder for each engine cylinder. To start, compressed air from the air tanks is admitted to the pump cylinders, which act to drive the engine until it picks up its cycle. This engine employs two separate cam shafts, one operating the oil valves and the other driving the pumps. The adjustment of the shaft is made by means of sliding spiral gears which drive the cam shafts. These sliding spiral gears are controlled by the longer lever on the left hand end of the engine. The short lever controls the starting air.

The other method is to use two sets of cams, one set being used for each direction of rotation. These cams are sometimes placed on the same cam shaft, which is made longitudinally adjustable under the lifters. A modification makes use of two cam shafts, one for ahead and the other for astern. These shafts may be swung in position under the valve lifters. Such an arrangement is shown in Fig. 2.

The reversing mechanism for the two-cycle engines is not quite so complicated as that for the four-cycle, the only valve mechanism necessary being that for the starting and fuel valves.

Probably the one feature of the Diesel motor which is causing its introduction into the marine field more than anything else, is its efficiency. Tests have been made on large engines of this type which show the almost remarkable figures of 0.38 pound of fuel used per brake horse-power hour. This is for crude oil. The marine engines of this type now in use average from 0.40 to 0.44 pound of fuel per brake horse-power hour while running under full load. When we compare these figures with those of the best triple expansion marine engines, which burn 1.46 pounds of coal per brake horse-power hour, we at once see the great advantage of the Diesel engine. In round figures, the Diesel engine will drive a ship just as fast and just as far on 100 tons of fuel, as a steam engine would on 350 tons of coal. Moreover, the liquid fuel may be stored in tanks placed in the double bottom of the ship; thereby giving space formerly occupied by the boilers and coal bunkers, over to passenger and cargo space. The earning power of the ship is thereby increased; the engine room space needed for an oil engine is just about the same as the engine room needed for the steam engine equipment.

The accessories needed for the Diesel engine require about the same space as the condenser and pumps of the steam engine.

The construction of the marine oil engine seems to follow along the standard lines laid down by steam engine practice; all the large oil engines so far constructed have a short piston and use flat guides, and a cross head with the ordinary open construction. It has been stated that it is poor practice to use the trunk piston, on account of the slight longitudinal movement of the crank shaft as the thrust bearings wear. With flat guides this slight play would make no difference, and the open construction also renders inspection easier.

The air pump for obtaining air for starting, and for fuel injection purposes, is generally obtained from a three-stage air compressor, which is driven from the cross heads of the three cylinders, air being cooled between the compressor stages. The circulation pumps are also driven from the main engine; but an auxiliary air compressor and auxiliary circulation pumps driven by smaller oil engines are provided for breakdown purposes. The bilge and fire pumps are either electrically driven, or driven by a separate engine, and electric current for light and power purposes is provided by direct-coupled generators driven by oil engines.

The oil engines in use at the present time—and building—comprise both two and four-cycle single and double acting. Each type has many good features of its own and it is almost too early to state which is the better; the construction of the two-cycle, double-acting engine is complicated, but the number of cylinders is reduced for a given power. On the other hand, in an engine with eight cylinders, one cylinder may not become inoperative without affecting the power of the engine to a very great extent.

It is safe to say that the development of the oil engine in this new rôle will proceed rapidly. With several German firms building large vessels equipped with oil engines, with the report that the German Admiralty is building a cruiser to be equipped with two six-cylinder engines each of 6,000 horse-power, and with several Glasgow firms building vessels similarly equipped, we shall soon see the oil engine given ample trials.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Revival of the Merchant Marine

To the Editor of the SCIENTIFIC AMERICAN:

I write to express my high appreciation of the great interest which since April 1st you have been manifesting in the upbuilding of the American merchant marine.

Everything published on this subject, either in your editorial or your correspondence columns, is greedily devoured by this writer, who for the past twelve years has made a special study of ship subsidy, mail subsidy, postal subvention, preferential duties, free ships, and every other measure suggested by human ingenuity for restoring that branch of our merchant marine engaged in the foreign or deep-sea trade to the proud position it formerly occupied.

The greatest difficulty in doing this seems to be in getting people living in the interior of the continent, remote from the seaboard, to take an interest in or to inform themselves on such matters.

The writer bids you Godspeed in the work you propose to undertake. JAMES G. MCBRIDE.

Canton, Miss.

One Man Who Saw the Meteor Train

To the Editor of the SCIENTIFIC AMERICAN:

Regarding the letter on your page 275 *re* "Meteor Train," I was one of a party of about a dozen at Mamaroneck, New York, who saw the appearance substantially as described by Mr. Pfarre.

Philadelphia, Pa. EDWARD T. CHILD.

Lessons of the Gordon Bennett Flying Race

To the Editor of the SCIENTIFIC AMERICAN:

With reference to the above subject in your issue of August 19th, will you kindly permit a few supplementary remarks in concurrence with Mr. Grover Loening's views thereon? Your contributor lays particular stress upon the difficulty experienced by such able exponents as Weymann and Leblanc in turning sharply at each pylon, and emphasizes on the other hand the facility and also marvelous "banking" performed by Ogilvie on the "Baby Wright."

Now it is certainly correct that this feat is difficult at all times with such superficial area out of all proportion in the case of the 60 square feet surface of the clipped Blériot, but it is also equally certain that the centrifugal force generated by the single tractor-screw is a factor not to be overlooked. That of the Nieuport was 7 feet diameter, the Blériot 8½ feet, while the twin propellers of the Wright are 8½ feet each, the last however revolving in opposite directions and thus counteracting centrifugal action magnified in the monoplanes. Consequently, the Wright—or its equivalent, a monoplane with twin propellers—is able to "bank" acutely in negotiating turns which would necessitate wide curves with the single-screw type or an alternative loss of stability and disaster. A still further point of importance with monoplanes driven by twin screws is the greater velocity attainable over the biplane similarly propelled, with furthermore the facility to forge against stronger winds—a real desideratum.

It is really extraordinary to note at the present moment the continuous copying universally of the Wrights' patent warping system, either flagrantly emulating the bending of the rear marginal tips in conjunction with the foot-operated vertical rudder, or the virtual reproduction of the same by means of ailerons —a system which although copied from nature is by no means the most powerful in controlling lateral stability by the bird. That perfect aviator among other methods demonstrates to us that by warping, or rather *depressing*, the outer half of one wing and correspondingly elevating the other, he obviates all danger of law litigation by encroaching on the Wright patent!

Well might Mr. Grover Loening in his able article refer to the emphasizing for the need of the "variable surface" monoplane shown by the Gordon Bennett race. Not only will greater speed be accomplished by the adoption of the bird-like wing, but so will inherent or natural stability be automatically secured in tumultuous winds by means of flexible construction in addition to this urgent need for variable surface. Therefore, the lessons demonstrated not only by the Gordon Bennett flying race, but by daily flights throughout the globe, for the production and evolution of the ideal mechanical flying machine, may be succinctly summarized in the following requirements: (1) The improvement of the car or fuselage in finer stream-line Nieuport form; (2) twin propellers of large diameter to thus engage a larger volume of air or "disk area," and rotating in opposite directions to minimize undue centrifugal force; (3) constructing the main planes flexible with small camber, high aspect ratio, and single-surfaced; (4) by superior lateral control other than that employed in the biplane of the Wrights and assured by the graduating of main spars toward the tips; (5) by variable surfacing of main planes or wings to insure higher speeds and susceptibility to encounter safely higher wind velocities by such diminution and augmentation of the supporting area; (6) the discarding of the vertical rudder acting in conjunction with the main planes for steering in the horizontal plane; (7) the need for compactly folding the wings against the side of a car when not in use or descent on water; (8) and the means for increasing or decreasing the angle of incidence of the main planes to suit the requirements of flight conditions. All the above essential features are by no means impossible to reproduce in one design, and will decidedly enable a monoplane to ascend and descend from water, and in due course to fly across the Atlantic.

London, England. EDGAR E. WILSON.

The Proposed Safety Stop Locomotive Throttle

To the Editor of the SCIENTIFIC AMERICAN:

In the correspondence department of your issue dated August 19th, on page 167, I noticed an article by Aubrey D. Beidelman, of Braintree, Mass., headed: "The Bridgeport Railroad Wreck."

In the last paragraph of his communication he offers the suggestion that the throttle and brake valve handle be provided with means to automatically bring them to positions that would shut off the steam and apply the brakes in the event of the engineer's becoming incapacitated from any cause. To quote from his article, "it would be necessary for the engineer to exert some little pressure on them" to prevent their action in this manner.

He questions if a device of this kind would be inconvenient. To my mind it would be insufferably so. In traversing a rolling country it is necessary for the engineman to frequently change the position of the reverse lever, requiring the use of at least one and usually both hands. It is at times necessary for him to use the injector on his side of the engine, due to the inability of the injector on the fireman's side to deliver sufficient water to the boiler.

It is not an unheard of thing for an engineman to find it necessary to fill the lubricator while on the road.

All these things take time; and while he was attending to them, the steam would be shut off and the brakes applied, causing a considerable and undesirable reduction in speed.

In addition to his physical duties, he has to keep in mind the orders he has received, which govern his movements with respect to other trains that may be on the road, their meeting and passing points, and what time he has in which to make a given point before another train. This would be extremely difficult for a man under the continuous physical strain that would be required to maintain these two levers in running position, especially in the case of the throttle, as he would have to exert considerable force to hold it open against a device that would have any value as a positive closing mechanism.

The conditions under which an engineman works at present are not what might be termed restful. There is continual jar and pound, as a locomotive compared to a coach rides about as easily as a hay wagon compared to a limousine.

If in addition to this a man were compelled to maintain a steady and unremitting pressure for a period of from three to seven hours, the average length of a passenger run, it would be almost if not quite beyond human endurance.

Los Angeles, Cal. J. B. WELLS.

Irrigation Supplementing Water Power

A New Joint Use for Our Canals.

To the Editor of the SCIENTIFIC AMERICAN:

In order to get at the power to be obtained from waterfalls, a height of 10 available feet is taken as a convenient basis to calculate any power from.

One cubic foot of water, weight 62½ pounds, falling 10 feet produces 625 foot pounds. Requirement for one horse-power, 33,000 pounds divided by 625, gives 52.8 cubic feet, required, for one theoretical horse-power, per minute.

But as wheel efficiency is seldom over 75 per cent, we add one-third to 52.8 or 70.4 cubic feet of water, which is sufficient to cover 844 square feet, or one-fifty-second of an acre. So that the amount of water required to produce one horse-power 52 minutes would cover one acre one inch deep, if none was wasted. But as the waste is considerable, let us assume that it requires two hours to cover one acre one inch, or in ten hours the water required to yield one horse-power would cover five acres one inch deep.

Now, as power can be generated, even in small units, for not over 20 cents per horse-power for ten hours, and in large units for much less, we have one inch of water costing four cents per acre, when for some crops it would be worth easily fifty times that, and others much more, as this water is warm rain water, and far superior to well water for irrigation purposes.

In view of the above statements, can we not safely conclude that our canals, or at least such sections of them as are favorably located, should be maintained for irrigation, which as explained below, may also reduce their value for water powers but little?

In many cases the canal is so located that all the water to be spared can naturally flow onto the lands, while in some cases a ditch to the next lock may be required to get the water high enough.

The very favorable results of some small irrigating experiments in our section, I think, will fully justify our valuable experiment stations in examining availably located lands, and in preparing necessary information as to suitable crops, fertilizers, sand mixing to lighten heavy soils, etc. That may enable the great increase in crops due to irrigating to be fully realized.

Now, if the power man, who is usually short of power, either for manufacturing or to sell electrically, will arrange his water wheels, etc., so as to give him the full power of the fall for say the best six months of the year, and will put in engines enough to develop the same amount of power, to be used when there is not water enough for all needed, which if for lighting will be less when water is lowest, he can have water power for all his needs for six months or more, and for nearly all the rest of the time part of the water, in fact most of it. Where the water is used only for ten hours for power, the irrigating can be done at night, as in the West. So that the power man can be in a better position, after the first cost of engine installment is paid, than if entirely dependent on the water power, as he will not only have increased power, but also power that can absolutely be depended on.

I trust that the above will be, in some way, a suggestion that will be a benefit to the community and the State in making use of its canals.

Dayton, O. J. H. STEVENS.

Automatic Stability in Aeroplanes—A Suggestion

To the Editor of the SCIENTIFIC AMERICAN:

Would you allow me to express through your valuable paper my opinion on the possible solution of the automatic lateral stability in flying machines?

The many devices designed and tried out to maintain automatic stability have as yet not met with the success which would be desirous. All further progress and the commercialization of aerial navigation depend upon the appearance of such a device. A suggestion of my own may lead to a possible solution of this problem. I describe my idea with a view of encouraging constructors of flying machines to experiment in this direction.

My automatic lateral stabilizer consists of fins, constructed of a light framework of wood or metal covered with a suitable fabric. These fins are hinged under the surface, at the extreme ends of the plane (wing tips) and can swing to both sides. When swinging inward such a fin can move until it lies flat under the surface, but toward the outward it is prevented by a strap from swinging farther than 45 degrees.

The function of the device may be conceived to be as follows:

When the plane is in motion, and as long as it is not influenced by a force caused by a side wind, the fins will be retained in a vertical position. But when the wind strikes the plane at an angle to the direction of motion, the fin nearest to the side from which the wind is coming will be laid flat under the surface of the plane. At the same time the fin on the opposite side swings outward to an angle of 45 degrees to the plane, and will present a resistance corresponding to the natural resistance on the windward side.

This arrangement seemingly works well when straight flights are made, and even in turning it seems likely to do all the banking required; but to straighten out the aeroplane after or at the termination of the turn, it may be found necessary to have recourse to the operation of ailerons. Even if this device needs at times to be supplemented by ailerons, it would do much to relieve the operator of an aeroplane of the continuous strain which the attendance of a lever mechanism to operate the lateral and the longitudinal stability means.

One of the main requirements would be to have the size of the fins in the right proportion to the plane which it serves as equalizer.

Such a device could be used on aeroplanes of all constructions, and to simplify the attachment of these fins the last five or six ribs on both sides should flatten out gradually, so as to make the extreme ends of the plane nearly flat.

Chicago, Ill. EWALD STEINHAUS.

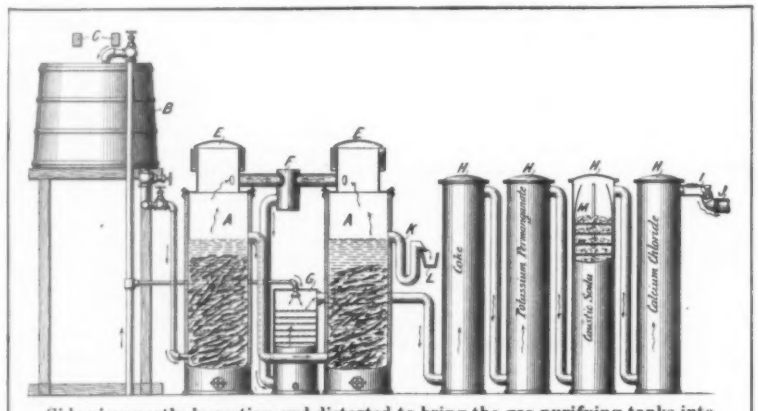
Filling a 400,000 Cubic-foot Balloon

Hydrogen-generating Plant for Vaniman's Transatlantic Expedition

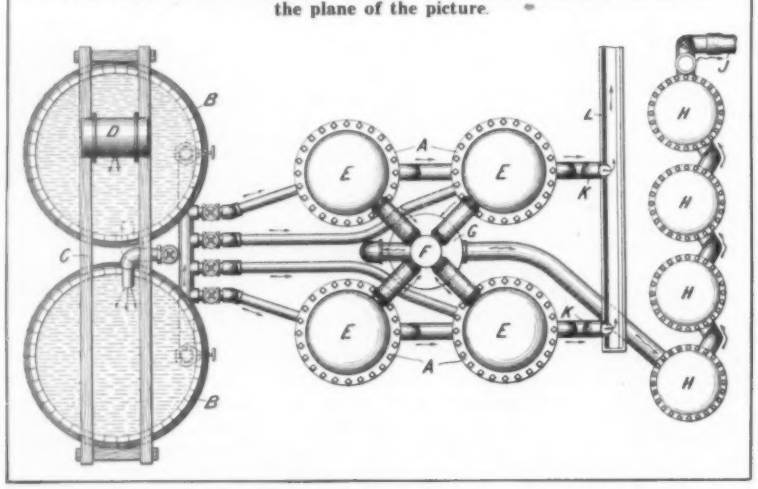
WHO would ever suppose that such coarse, heavy stuff as rusty barrel hoops, iron filings and chips, lathe turnings, and other scraps of the machine shop would enter into the manufacture of the most tenuous and imponderable substance on earth? Of course the initiated know that hydrogen may be made by treating iron with sulphuric acid, and that this is the way that the gas with which balloons are inflated is commonly made. It is the sulphuric acid that contains the hydrogen; the iron serves merely to take up the sulphur and oxygen that form the bulk of the acid, thus liberating the hydrogen. Since in sulphuric acid there is but one part by weight of hydrogen to forty-eight of sulphur and oxygen, a large quantity of acid is required to produce enough hydrogen for an ordinary balloon, and when it comes to such huge airships as the "Akron," with which Mr. Vaniman intends to attempt a transatlantic flight this fall, the amount of acid required is enormous. The gas bag of the "Akron" is 258 feet long, and 47 feet in diameter, with a capacity of 400,000 cubic feet. As the average street blocks of New York measure 250 feet and the width of Broadway downtown is but 40 feet from curb to curb, some idea of the huge bulk of the balloon can be obtained. To fill this huge gas bag, a large plant was built at Atlantic City. Nearly 80 tons of scrap iron was carted to the plant and 100 tons of sulphuric acid in large casks, containing over 16,000 pounds each. These materials were capable of producing 450,000 cubic feet of hydrogen gas. An equal quantity of coal gas would supply an average town of 10,000 inhabitants for three days, and if the gas were fed to an ordinary five-foot gas burner, it would take more than ten years to exhaust the supply. For five days and nights the plant operated continuously, generating hydrogen, which was carried directly into the huge gas bag.

The bag is made of three thicknesses of cotton cloth, gummed together with thin layers of rubber, and its total weight is considerably over two tons. This, of course, is the weight of the bag in air when not inflated. It is always confusing to speak of weights when referring to a balloon. It is difficult to conceive that the hydrogen in the balloon has any weight, and yet if the balloon were in a vacuum it would crash to earth with a tremendous impact, for not only does the envelope weigh many thousand pounds, but the gas itself would weigh over a ton.

The accompanying drawings, which are somewhat diagrammatical, will serve to illustrate the process of producing the gas for the "Akron." One is a true plan view of the plant, and the other a distorted elevation, partly in section.



Side view partly in section and distorted to bring the gas-purifying tanks into the plane of the picture.



Plan view of the hydrogen-generating plant; course of liquid shown by straight arrow, course of gas by crooked arrows.

Those who are acquainted with the usual methods of generating hydrogen for balloons will notice a number of innovations introduced by Mr. Vaniman, whereby there is no interruption in the generation of the gas. As indicated in the plan view, there are four generator tanks *A*, which are made of wood with all the iron parts well coated with pitch to prevent the sulphuric acid from attacking them. These tanks are partly filled with scrap iron. The sulphuric acid is fed into the tanks from one of two large reservoirs *B*. Over the reservoirs is a track *C*, on which the sulphuric acid casks *D* are supported. In order to prevent too rapid a generation of gas and choking of the tanks with ferrous sulphate, the sulphuric acid is diluted.

For every part of sulphuric acid, eleven parts of water are used. While this mixture is being prepared in one of the reservoirs, the other is tapped, and the dilute sulphuric acid takes the course indicated by the arrows to the bottom of the generator tanks. It may flow directly into any one of these tanks or may be made to flow from one pair of tanks into the other. The latter is the more economical method, as it insures complete action of every particle of the acid. The gas generated in the tanks rises to the top, where it is trapped by gasometers *E*, and flowing into a common chamber *F*, passes down to the washer *G*. Here it is forced to make its way upward through a series of perforated plates, while a spray of water flows downward through the same plates. Thence the gas passes through four tanks *H*, the first containing coke, the second potassium permanganate, the third caustic soda, and the fourth calcium chloride. The first two serve to purify the gas of such materials as arsenic, sulphur and phosphorus, which are apt to be picked up from the iron. The other two tanks serve to remove all traces of moisture from the gas.

Hydrogen is an odorless, colorless gas, and it would be impossible to detect leaks in the balloon were not some means used to impart an odor to the gas. The "perfume" commonly used is muronine. This is placed in a sponge as indicated at *I*, and thence the gas is fed directly into the balloon through the tube *J*. The "perfume" used has a most penetrating sickish odor, that can readily be detected, no matter how small the perforation in the bag through which the gas is escaping.

One of the advantages of the arrangement shown in the drawing is that when it is desired to charge one of the generators with fresh scrap iron it may be cut out of the system completely by turning off the pipe conducting the sulphuric acid to it and also placing a clamp on the rubber hose connecting the gasometer of that particular generator with the chamber *F*. The spent liquor flows from the generators through traps *K* to a trough *L*, which leads to a large trench or drain.

Heretofore the purifying and drying tanks have been filled with coke in which the various cleansing chemicals were sprinkled, the purpose of the coke being to prevent the materials from clogging. This method has caused much trouble because the materials would slowly gravitate to the bottom of the tanks, choking the flow of gas. Whenever such a condition arose, it was necessary to shut down the entire plant and clean out the tanks. Mr. Vaniman has adopted a different method. He uses a set of trays of copper netting secured to iron straps, as indicated at *M* in the drawing, and on these trays the purifying and drying materials are placed. Thus the mass is kept in a porous condition, through which the gas can easily percolate, and in case of any trouble the entire set of trays can be lifted out bodily.

The Trade Winds of Porto Rico

DR. O. L. FASSIG, of the United States Weather Bureau, is one of America's few able climatographers, and is well known for his exhaustive treatises on the climate of Maryland and of the city of Baltimore. For the past two years he has had charge of the Weather Bureau station at San Juan, Porto Rico, and he has of late published a number of useful and timely monographs on Porto Rican climate. The latest, which appears in the *Monthly Weather Review*, deals with the trade winds.

Although the trade winds of the northern hemisphere are commonly supposed to blow from the northeast, this is hardly their prevailing direction in the West Indies. In Porto Rico their general direction, taking the year as a whole, is between east and southeast, though the percentage of northeast winds increases during the winter. As to diurnal variations, the prevailing direction during the daytime (9 A. M. to 10 P. M.) is east, while during the night, after 10 o'clock, it is southeast. This applies to the year as a whole, but during July and August the prevailing east wind extends far into the night; viz., to 1 or 2 o'clock in the morning.

The average hourly velocity of the trade winds for the year is a little under 11 miles, the monthly values ranging from 8 miles an hour in October to 13 miles in July. On an average these winds are lightest about sunrise and strongest about 2 o'clock, at San Juan. The trade winds of course never rise to the force of a gale, and the few high winds that occur in Porto Rico are generally due to the passage of tropical cyclones.

Judging from the movement of clouds over San Juan, the average depth of the trade-wind current in this region probably does not exceed 10,000 feet. The upper clouds—the cirrus forms—have a nearly uniform movement from the western quadrant; that is, they show that the upper air current is opposite in direction to the trades.

The trade winds contribute greatly to the good health and comfort of the inhabitants of Porto Rico. In fact, it is the presence of the steady, moderate flow of the trades that takes this island out of the class of areas in the tropics to be avoided by white men, and makes it for more than half the year a very desirable place of residence for business as well as for pleasure.

The utilization of the trade winds as a source of motive power is gradually receiving proper recognition, and the number of wind-mills is increasing. The south side of the island is comparatively dry, and the rainfall is irregularly distributed through the year, necessitating extensive irrigation operations; while on the north side the drainage problem is almost equally important. In both these operations wind-driven pumps might be used to great advantage.

Nature's Parachutes

CAREFUL examination has been made of the heads of Canada thistle-downs, in order to determine their effectiveness as parachutes, carrying the seeds of the plant to great distances through the air. The results of this examination are quite remarkable.

Calculation shows that a thistle-down starting from an elevation of 20 feet, in still air, would require two-thirds of a minute to reach the ground. With a wind blowing 20 miles an hour it would be carried, on the average, about a fifth of a mile. The total surface exposed to the air in an average thistle-down is, on account of the great number of hairlets, a little more than one-third of a square foot. Another well-known and very beautiful example of nature's parachutes is furnished by the light silken threads with the aid of which the little gossamer spider makes long aerial voyages.

Suggestions for the Workshop

Ingenious Expedients of Resourceful Mechanics

Handy Man's Medicine Chest

To the Editor of the Workshop Department:

In looking over Handy Man's Medicine Chest, in the issue of September 9th, I notice that the collodion dressing with aristol or iodoform added calls for 50 grams to the ounce. I intended this to read 50 grains. This amount would do more harm, but as there are only 31.1 grammes to the ounce, by using 50 grammes of aristol you have more aristol than collodion, which I fear would be an almost useless mixture. The mistake of reading grams for grains is often made by druggists, and for this reason I believe that when grammes is intended, it should be written out in full (grammes).

WILLIAM R. INGHRAM, M.D.

Dangers of Gasoline Vapor Cleaning

To the Editor of the Workshop Department:

The description of an automobile cleaning device published among the "Suggestions for the Workshop," on page 276 of September 23d issue, is of considerable interest from an insurance point of view, from the fact that *the vapor from one pint of gasoline will make 200 cubic feet of air explosive*. The device seems to be an excellent gas generator; a flame some distance away will ignite the vapor, and the operator of the cleaner will never know what hit him.

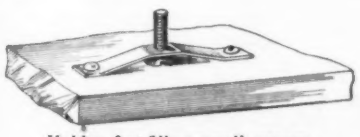
Would it not be well to caution your readers against the use of such a dangerous machine?

P. D. C. STEWARD.

Holder for Filing Small Screws

By B. F. D.

WHEN a small screw is to be filed down to shorten it, it is not advisable to put it in a vise for fear of damaging the threads.



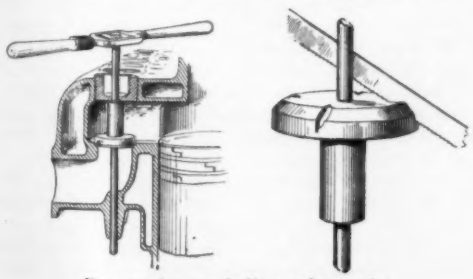
Holder for filing small screws.

A small piece of soft iron may be bent and drilled in the manner shown in the illustration, and then screwed or nailed to the bench top with the screw in the position shown.

Refacing Valve Seats

By Albert F. Bishop

WHEN refacing the valve seats of an automobile engine, it is usually the practice to make a reamer out of cast steel and temper and grind it to size. This is rather a tedious task and somewhat expensive. Recently a friend of the writer found it necessary to reface the valve seats of his four-cylinder automobile engine, which meant that there were eight valves to be treated. Instead of adopting the usual method, the writer suggested that he make his reamer of soft steel, and fit it with cutting edges by sawing through the beveled edge of the reamer with a hack saw in four places and driving in four pieces of clock spring. These cutters were filed down nearly



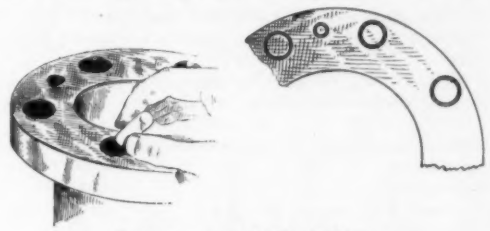
Reamer for regrinding valve seats.

to the surface of the reamer. The bevel was finished in the lathe with the grinder, allowing the clock spring strips to project about 0.02 of an inch, or less, from the surface. Small grooves were filed in the reamer in front of the cutting edges to allow for clearance of chips. The lower end of the reamer was made to fit nicely in the guide for the valve seat. One of the plugs in the engine directly over the valve was bored out to fit the upper part of the reamer. This plug not only held the reamer accurately, but also acted as a feed; for it could be screwed down as the reamer was revolved. The eight seats were refaced with perfect ease, the last one cutting as well as the others. When the work was completed, the hole bored in the plug was stopped up with a piece of metal, and the plug was replaced in the engine for service. The valves were placed in the lathe and faced off enough to true them, after which they were inserted in the engine and ground to a fit with powdered glass and oil.

Laying Out Work for Drilling

By George F. Brown

A QUICK and accurate way of obtaining an impression of the holes already drilled in a flange when a new flange or cap is to be fitted to it, is to rub a piece of chalk down into the hole so that the edge will scrape off a small amount, forming a bead of chalk that is slightly raised above the surface of the flange. On the flange thus prepared the new flange is laid in



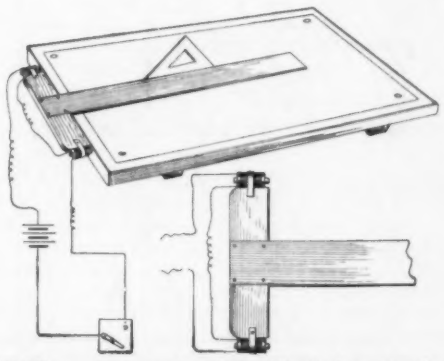
Laying out work for drilling.

the exact position in which it is to be bolted. On removing the chalked flange an accurate tracing of each hole will be found on the new flange. These circular tracings can be centered and drilled and they will be sure to mate the holes in the other flange when it is replaced for bolting.

Magnetic T-Square

By William Grötzinger

WHEN much hatching is to be done there is always a tendency to move the T-square out of position because it is necessary to hold the T-square and at the same time to manipulate the triangle and the ruling pen. To eliminate this trouble the writer took two small electro-magnets out of an old door bell, and fastened one on each end of the head of the



Holding a T-square in place with electro-magnets.

T-square, taking care to get the magnet cores on a line with the edge of the head.

Then a piece of thin iron band was fastened to the edge of the drawing board with several small screws. The magnets were connected in series with a battery and switch. When turning on the current, the magnets will hold the T-square firmly against the drawing board. Then all one needs to do is to attend to the triangle and the pen. This will eliminate slipping of the T-square and make for accurate work.

Flywheel Brake

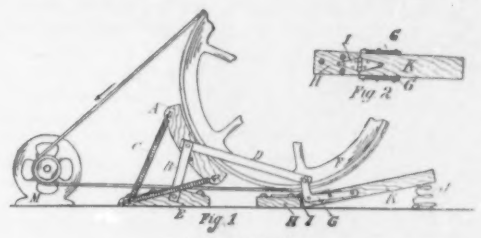
By C. M. Moon

THE brake illustrated herewith was designed for use on the flywheel of a heavy Gordon job printing press, having the driving motor belted to the flywheel. It was necessary to construct the brake in such a way that the parts would not interfere with the driving belt.

As will be seen by referring to the illustration, *M* represents the motor; *A* is the brake shoe, which is supported by two legs, *B*, with the belt passing between them. These legs are bolted to the block *E* which is securely fastened to the floor. The coil springs *C* assist in holding the brake shoe away from the wheel, and also keep the ends of the shoe from rubbing. The brake shoe is connected by means of two drawbars *D*, one on either side, with the two bell cranks *G* which are screwed to the sides of the foot lever *K*. These bell cranks, drawbars, and brake shoe legs are made from ¾-inch band iron, ¼ inch thick.

The foot lever is connected with the block *H* by means of a 6-inch strap-hinge *I*, as will be noted in Fig. 2 of the sketch, and the block *H* is securely fastened to the floor with lag screws. The coil spring *J* holds the outer end of the foot lever about three inches above the floor, and also assists in holding the brake shoe away from the flywheel, except when stopping the machine. The spring used was an old-fashioned bed spring, which answers the purpose very well.

The brake shoe, foot lever, and floor blocks should



Flywheel brake.

be made of hard wood if possible, but any kind will do the work. If desired, the shoe may be faced with a piece of leather belting, smooth side outward, which gives it a much better grip on the wheel.

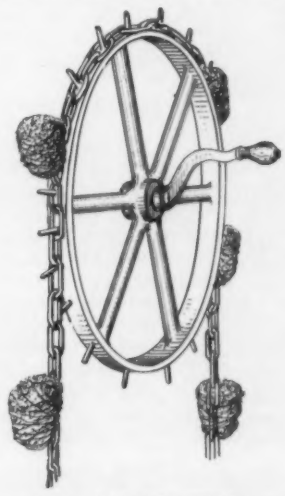
This brake is very powerful on account of the leverage obtained at the foot lever, and also because of the fact that the brake-shoe legs are not placed perpendicularly, but incline somewhat toward the flywheel; thus when the brake is applied, the friction tends to force the shoe more tightly under the wheel.

With this device the machine may be brought to a stop slowly, or in case of accident, almost instantly, by increasing the pressure upon the foot lever.

Repairs to a Cistern

By J. W. Romig

A FRIEND of mine has a traction engine, and one day while on the road he found that he had very little water left. Just at this time they were passing an old deserted house whose cistern was about half



Improvised cistern chain.

full of water, but the rubber buckets were rotted off; so taking some cotton waste from the engine he made buckets with this, and got enough water to complete his run.

Workshop Notes

To Sharpen Chisels.—Often one has chisels of awkward shape, and no stone with which to sharpen them. If a piece of wood is cut to fit the chisel, it can be used in place of a stone, by dipping it in a mixture of oil and powdered emery, and then manipulating as an ordinary stone.—B. FRANCIS DASHIELL.

Soldering Galvanized Iron.—Raw soldering fluid is generally used on the soldering copper when it is desired to solder galvanized iron. However, before commencing to solder, it is desirable to dip the soldering copper while hot in a solution of sal-ammoniac and water. This will retain the tin on the point of the soldering copper, which would otherwise soon disappear.—A. F. B.

Disposition of Guns in Dreadnoughts

Foreign Navies are Adopting the American Center-line Plan

By Percival A. Hislam

THE total number of ships of the all-big-gun type now built, building, or provided for in the current year, is exactly one hundred. Great Britain leads with thirty-two (which includes two cruisers building at the cost of Australia and New Zealand), followed by Germany with twenty-one, and the United States with twelve. Japan, having this year placed orders for no fewer than five ships of the type (one building in England and four to be laid down in Japan), has increased her total to seven. Russia, France, Italy and Austria have four ships apiece, none being yet completed, and the first-named power proposes as soon as possible to raise her total to twelve. Brazil and Spain each possesses three "Dreadnoughts," two of the Brazilian only being completed; and the list is completed by the Argentine Republic, with two ships on the stocks; Turkey with two recently ordered in England; and Chili with two which are shortly to be placed out to contract.

In this total of a hundred ships there are thirty-one whose details either have not yet been decided upon or are not yet known. The policy of secrecy, inaugurated by Great Britain with her pioneer "Dreadnought," has been followed by several other powers. Germany conceals the particulars of her new warships very successfully, and only nine can be spoken of with any certainty. Latterly, Great Britain has relaxed the policy, and the only vessels whose details are uncertain are the five of the 1911-12 programme. Nothing is known of this year's quintet of Japanese ships except that they will carry 13.5-inch guns; and other ships where similar lack of certain knowledge exists are the new American vessels to be laid down this year (which, it is expected, will have ten 14-inch guns in two twin and two triple turrets), the last two of the four Austrian vessels, the Turkish and Chilian ships, and the Brazilian "Rio de Janeiro." The last-named vessel was for some time reported to be designed to carry twelve 14.5-inch, fourteen 6-inch, and fourteen 4-inch guns; but it has latterly been stated that she will after all be no more than a replica of the "Minas Geraes" and "Sao Paolo."

In the case of the sixty-nine ships whose principal details are known, there is a very wide divergence in the mounting of the main battery. This would necessarily follow from the fact that some are armed with eight, some with ten, some with twelve, and three even with thirteen heavy guns; but there are also considerable differences even among ships with the same number of guns.

The first "Dreadnought" to be laid down and completed—the British ship of that name—has ten 12-inch guns so arranged as to produce a broadside efficiency of 80 per cent (Fig. 10). Three turrets are on the center line, and so can bear on either beam; but the other two are placed abreast on the beams, so that each can bear on only one broadside. In a broadside engagement, therefore, two guns out of ten would be useless. In spite of the obvious drawbacks of the arrangement, however, it was repeated in six later ships—"Bellerophon," "Temeraire," "Superb," "St. Vincent," "Collingwood," and "Vanguard"; and the result is that these seven ships, if they formed one battle unit, would have no fewer than fourteen 12-inch guns out of seventy useless for a line-ahead action.

These seven British ships are the only five-turreted dreadnoughts which cannot dispose 100 per cent of their heavy guns on the beam. The American five-turreted ships "Delaware," "North Dakota," "Florida," and "Utah" (Fig. 6) have all their turrets on the middle line, with the result that these four ships, mounting ten 12-inch guns apiece and forty in all, are equal in broadside action to five of the British ships mounting fifty 12-inch guns, since only forty of these could be brought to bear on the beam. We are not dealing here with secondary batteries; but the best five of these seven British ships mount ninety-two 4-inch all told (twenty each in the "St. Vincents," and sixteen in the "Bellerophons"), while the four American vessels have sixty 5-inch, which, allowing for the much greater power of the 5-inch gun, is in all probability a superior equipment. In her later vessels Great Britain began to show signs of being influenced by the full-broadside argument. Its force was, however, admitted grudgingly, and a wavering effort made to combine a full broadside with a heavy fore and aft fire. The "Neptune," "Hercules," and "Colossus" were the result (Fig. 9). These ships, like the earlier "Dreadnoughts," have three turrets on the middle line, but the wing pair are placed *en échelon* across the deck amidships, while the last turret but one from aft is super-posed to fire over the aftermost. The result is that six guns can be fired ahead and eight aft is superposed to fire over the aftermost. The be covered by all ten guns. Over a large angle, however, the fire of the port turret is masked on the starboard side by the starboard turret, and *vice versa*, and the lengthy experiments which were carried out in the Mediterranean early this year are believed to have proved that the compromise is not a very happy one.

At any rate, it has been abandoned in later ships. The "Orion," "Thunderer," "Conqueror," and "Monarch" (1909-10 programme), and the "King George V.," "Centurion," "Ajax," and "Audacious" (1910-11 programme), will have ten 13.5-inch guns in five turrets, all on the center line. The second from forward will be superposed, so that four guns will bear forward; and the same arrangement is repeated aft, the fifth turret being amidships (Fig. 7). In these ships, therefore, Great Britain for the first time acknowledges the superiority of the all-on-the-center-line system which has been applied to American "Dreadnoughts" since the first was designed. The ten 14-inch guns of the "Texas" and "New York" will be mounted on this plan.

The last of the known five-turreted ships are the Italian vessels "Conte di Cavour," "Leonardo da Vinci," and "Giulio Cesare." In the case of the last two it is possible that the original design may not be adhered to, but they were all designed to carry, and the "Conte di Cavour" at any rate will be equipped with, thirteen 12-inch guns arranged as shown in Fig. 11 of the diagram. There will be three three-gun turrets, one forward, one aft and one amidships, and two twin-turrets will fire over the fore and aft turrets respectively. There will thus be a full broadside fire of thirteen 12-inch guns, while five will bear ahead and astern. If this arrangement is not carried out in the other two ships it will be to allow of the mounting of heavier guns. It may be mentioned that the guns in the triple-turrets are arranged on two levels, two being below, and the third above and between them. In this way the breadth of the turret is saved at the cost of additional height.

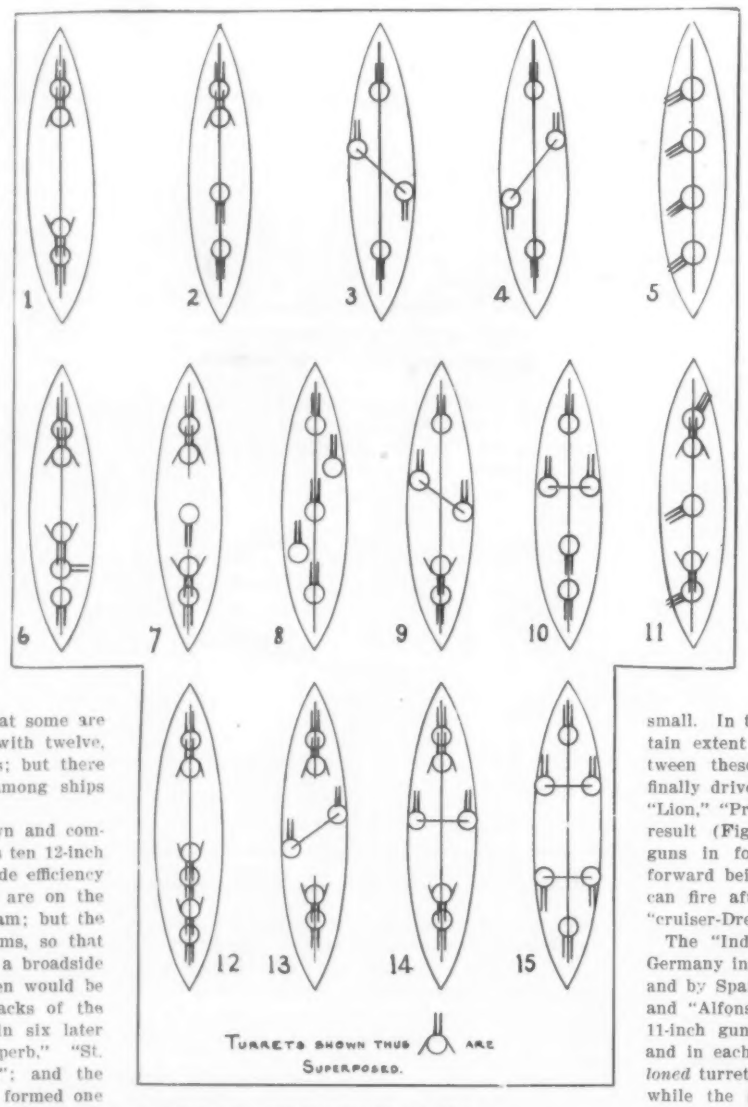
There are comparatively few four-turreted "Dreadnoughts." The first were, of course, the American "Michigan" and "South Carolina," although for various reasons they were not at sea until after the British "Invincible" cruisers. The "Michigans" have eight 12-inch guns in four turrets, two forward and two aft, the one nearer the middle of the ship being superposed in each case (Fig. 1). The British "Invincible," "Inflexible," and "Indomitable" also have a nominally full broadside (Fig. 3), two turrets being on the center line, and two *en échelon* amidships; but the latter (as in the "Neptune") are so close together that the arc covered by eight guns is very small. In the "Indefatigable" this fault was to a certain extent remedied, by increasing the distance between these two turrets; but the authorities were finally driven to adopt the American system, and the "Lion," "Princess Royal," and "Queen Mary" are the result (Fig. 2). These ships have eight 13.5-inch guns in four middle-line turrets, the second from forward being superposed. Only two guns, therefore, can fire aft, as compared with six in the previous "cruiser-Dreadnoughts" built for the British navy.

The "Indefatigable" system has been followed by Germany in the case of the "Von der Tann" (cruiser), and by Spain in the battleships "Espana," "Jaime I.," and "Alfonso XIII." The "Von der Tann" has eight 11-inch guns and the Spanish vessels eight 12-inch; and in each the longitudinal space between the *échelon*ed turrets is much more than in the British ships, while the starboard turret, instead of the port, is nearer the bows (Fig. 4). The British cruisers "New Zealand" and "Australia," building for Pacific service, are similar to the "Indefatigable."

The other known four-turreted ships are equipped on the triple-turret system, which has lately come into considerable vogue. All are armed with twelve 12-inch guns, their names and nationality being: "Petropavlovsk," "Poltava," "Sevastopol," and "Gangut" (Russian), "Dante Alighieri" (Italian), and "Viribus Unitis," and a vessel at present known as "V" (Austrian). It has been rumored that in the case of the Austrian ships two turrets will be superposed, but this lacks confirmation (Fig. 5).

"Dreadnoughts" with six turrets are again comparatively few in number, but present some striking contrasts. The American "Wyoming" and "Arkansas" have twelve 12-inch guns in six center-line turrets, two forward and four abaft of the superstructure.

(Continued on page 326.)



1. Michigan, South Carolina (U. S.), 12-in.
2. Lion, Princess Royal, Queen Mary (British), 13.5-in.
3. Inflexible, Invincible, Indomitable, Indefatigable, New Zealand, Australia (British), 12-in.
4. Espana, Jaime I., Alfonso XIII (Spanish), 12-in. Von der Tann (German), 11-in.
5. Gangut, Poltava, Petropavlovsk, Sevastopol (Russian); Viribus Unitis, "V" (Austrian); Dante Alighieri (Italian), all 12-in. Plan 3, with triple turrets, has been suggested for Russian ships.
6. Delaware, North Dakota, Florida, Utah (U. S.), 12-in.
7. Texas, New York (U. S.), 14-in.; Orion, Thunderer, Conqueror, Monarch, King George V., Centurion, Ajax, Audacious (British), 13.5-in.
8. Plan suggested by Mr. James McKechnie (of Messrs. Vickers) for 16,000-ton ship fitted with internal combustion engines.
9. Neptune, Hercules, Colossus (British), 12-in.
10. Dreadnought, Bellerophon, Temeraire, Superb, St. Vincent, Collingwood, Vanguard (British), 12-in.
11. Conte di Cavour, Leonardo da Vinci, Giulio Cesare (Italian), 12-in.
12. Wyoming, Arkansas (U. S.), 12-in.
13. Moreno, Rivadavia (Argentine); Minas Geraes, Sao Paolo (Brazilian), 12-in.
14. Courbet, Jean Bart, France, Paris (French), 12-in.
15. Kawachi, Settsu (Japanese), 12-in.; Nassau, Westfalen, Rheinland, Posen (German), 11-in.; Ostfriesland, Helgoland, Thuringen, Oldenburg (German), 12.2-in.

THE DISPOSITION OF GUNS IN DREADNOUGHTS

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Atmospheric Pressure in Past Geological Ages

THE modern development of aviation suggests the question whether the atmosphere of the earth was denser during the carboniferous epoch than at the present day.

This subject is briefly discussed by a writer in *Cosmos*, whose remarks we reproduce here.

"Among the animals which people the earth we find representatives of all sizes, from the microscopically small animalcule to the great elephant. But within the limits of any one species the scale upon which the individuals are built does not differ very materially; we do not, for example, find specimens say ten times larger than their adult congeners.

"It is easy to show good mechanical and physical reason why this should be so. Consider two birds, geometrically similar, such as two swallows for example, and imagine the second to have ten times the normal size. This bird will then have all its linear dimensions ten times as great as the normal bird, while the surfaces will be one hundred times as great. In this way all the cross sections, the thickness of the muscles, especially of the wing muscles, being increased one hundred fold, we may safely take it that the strength of the bird will also be increased in the same proportion. But on the other hand, it must be remembered that the volume, and hence the weight of the body, will be increased one thousand fold. Thus this large swallow, built on ten times the normal scale, would find itself quite unable to rise into the air or to sustain itself there, for it is relatively ten times less strong than its congeners: with muscles one hundred times as strong as theirs it is called upon to perform one thousand times the work.

"As a matter of fact, an examination of the flight of different kinds of birds having approximately the same form shows that flight becomes more and more difficult as the weight increases; large birds substitute as far as possible sailing flight (which is the characteristic motion of our aeroplanes) for flapping of the wings. Thus the size of animals capable of flight has an upper limit, and this seems to be reached, in the present state of nature, by the large birds, so far as sailing flight is concerned, and by the large insects, so far as flight by wing vibration is concerned.

"And yet in past ages much greater animals have flown. One reptile of the group Pterodactyl had a span of over thirty feet, which exceeds that of a racing Blériot; this creature lived during the cretaceous period and flew as far as 90 miles inland. Certain dragon flies of the carboniferous era measured over three feet from tip to tip of their outspread wings. Under present conditions it would be quite impossible for these creatures to fly. The most natural supposition is that in the times when these creatures flew through the air, the atmosphere had a greater density than it has at present. This is the conclusion reached by Mr. Harle. In the estimation of this paleontologist, the existence of these great flying animals during cretaceous and carboniferous times indicates that atmospheric pressure at that time was greater than at present."

The Autogenous Cutting Process in Handling Wreckage

FOR some time past, the well-known autogenous fusing process (oxy-acetylene blowpipe) has been used with great success for clearing up wreckage after fires, explosions, and similar accidents. An interesting case occurred in a town in Germany, where a school building in the course of construction collapsed, burying a number of workmen under the debris. As good fortune would have it, an oxy-hydrogen cutter happened to be available in the immediate neighborhood, and with its aid the iron parts were cut through in short order, and the workmen were extricated from their hazardous pr'son.

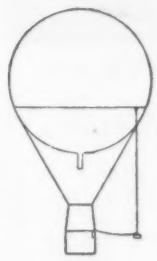
The importance of the oxygen blast is, of course, still greater in cases in which the construction is entirely made of iron. Thus, for instance, it was very extensively used in clearing up the wreckage after the collapsing of a large gasometer in Hamburg in December, 1909.

The lightning rapidity of the cutting burner is of particularly great utility in the case of railway disasters, where it is essential that the work be performed as quickly as possible so as to clear the road. At the present day, numerous railway corporations have adopted autogenous cutters as a part of the equipment of their wrecking cars. Municipal fire departments also have installed this apparatus.

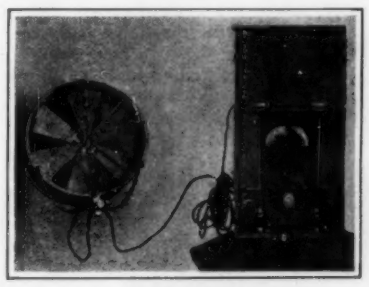
In Germany the process is almost universally carried out with hydrogen and oxygen instead of acetylene and oxygen, because the hydrogen is readily compressible into steel bottles, while acetylene cannot be thus stored without special precautions, since it is liable to explode.

The Kodophone

IT is very desirable for an aeronaut to know the vertical velocity of his balloon, relatively to the air. Instruments for indicating this relative velocity have been invented by Neumann and by Lentz. The name Kodophone has been given by Lentz to his instrument, which is described as follows in *Prometheus*: A small windmill is suspended from the balloon, with its plane of rotation horizontal, in the manner indicated in the diagram. The windmill is connected by wires with two electric bells of different pitches and a battery, contained in a case which is attached either to the side of the car or to the suspension ring above the aeronaut's head. The connections are made in such a manner that one bell sounds when the balloon rises, and the other when it sinks, relatively to the air. The velocity of relative ascent or descent is indicated by the length of the interval between successive strokes of the bell. This automatic device is especially valuable at night and at any time when the aeronaut's attention is distracted for any reason.



Kodophone attached to balloon.



The Kodophone.

A Practical Manufacturer on the Synthesis of Rubber

IN the May number of the new journal *Kunststoffe*, Dr. Gerlach-Hannover, a practical rubber manufacturer, makes the following statement:

"The problem of producing caoutchouc synthetically has been solved. But just as in the case of indigo 20 years elapsed before the synthetic product was successfully launched, it will take at least 20 years before synthetic rubber will make its appearance commercially. It will take perhaps longer with caoutchouc because the physical properties of this material are not as well known as those of indigo. The high price of the natural product stimulated research and, after the pioneering experiments of Harries, the Elberfeld Farbenfabriken have finally succeeded in producing larger quantities of a product derived from a material closely related to isopren. At this stage of the development it was found out that there exist many sorts of rubber which are near relatives, but still possess different characteristics.

"The first synthetic caoutchouc which was placed at my disposal, for example, did not unite with sulphur and had a leathery appearance. This was not to be wondered at, as there are known some varieties of natural caoutchouc which cannot be vulcanized. Soon another sort of rubber came to my notice which showed better affinity for sulphur, but still could not be perfectly vulcanized. Above all it lacked elasticity. Soon, however, larger quantities of a third sort were submitted to me which to my great astonishment showed all the excellent properties of natural rubber.

"But now the question arises whether this material of the Elberfelder can be economically produced on a large scale and may thus become a danger for natural rubber. It cannot be denied that the substance, which possesses good qualities, can be utilized for practical purposes. Its price is not high but it is a complex question to decide whether this synthetical product will become a danger to natural rubber. All kinds of economical and commercial conditions must be taken into consideration. One thing, however, is certain, that synthetic rubber will soon be a commercial article."

Highway Engineering as a Profession

ACCORDING to Prof. Arthur H. Blanchard, who recently lectured before the Society for the Promotion of Engineering Education, the technical graduate who is attracted to highway engineering has several more or less well-defined fields open to him. These are:

"The highway departments of municipalities and towns; those of States, counties and parks; the engineering organizations of contractors; and the engineering and sales departments of companies dealing in materials and machinery used in highway work. In city and town work matters relative to the construction and maintenance of streets and pavements compose the bulk of the work assigned to the highway departments, together with more or less road engineering problems. With State, county and park departments, the construction and maintenance of all types of road surfaces and bituminous pavements constitutes 90 per cent of the work of such organizations, while certain problems in street pavements and highway bridges have to be dealt with occasionally. The prevailing idea, however, that the two fields just mentioned are easily separable, and that the preparation for one should not be the preparation for the other, is essentially wrong. Since the lines of demarkation between the above fields are rapidly becoming obliterated, the successful highway engineer of to-day, whether engaged by the city or State, must have a comprehensive knowledge of all branches of highway engineering and allied subjects. Otherwise it is obvious that it will be impossible to follow that important principle of economics of highway engineering, the adaptation of methods and materials to local conditions.

"In contemplation of these opportunities, the essential prequisites of a successful career as a highway engineer must be given due consideration in order that the future prospects offered by this field of engineering may be thoroughly understood."

Prof. Blanchard recommends four years' training in a course in civil engineering, practical experience in both field and office in connection with the construction and maintenance of roads and pavements on a system of highways, and the acquisition of knowledge along certain lines of particular value to the highway engineer, by which last is meant knowledge of the economics of highway engineering, materials of highway engineering, management engineering, highway laws and systems of administration, mechanical appliances used in highway engineering, highway bridges and culverts, road and street surveying, drafting and designing, methods used in road material laboratories, advanced dynamic and structural geology, lithology, petrology and petrography, processes of industrial chemistry, methods of testing bituminous materials and the interpretation of results, and finally advanced highway engineering covering the most recent practice throughout the world in the construction and maintenance of all kinds of roads and pavements.

The problem before the educational institutions of this country is that of determining by what method the subjects outlined above can be offered upon a practical basis. Prof. Blanchard does not favor a four years' undergraduate course in highway engineering, partly because undergraduate students are not sufficiently mature to acquire the benefits which should be derived from a combination of practical experience and specialized knowledge.

The most practicable plan is to arrange a definite course of instruction as a unified graduate course based on the assumption that the technical graduates enrolled for the master's degree will hold undergraduate degrees in civil engineering. If the graduate instruction is to be given in the period from about December 1st to about April 1st, it will be possible for practising highway engineers, especially first, second, and third-year graduates, to use the winter period advantageously in acquiring advanced knowledge under favorable circumstances.

Columbia University will offer a course next year which will cover the field of subjects referred to in Prof. Blanchard's paper, and will, in amount, be sufficient to satisfy the requirements for the master's degree.

The Heavens in October

Some Difficulties in Plotting Comets' Orbits

By Henry Norris Russell, Ph.D.

ALMOST the only real difficulty in preparing such articles as these arises when a new comet is discovered. To give a detailed account of its motions during the ensuing month, the writer must have before him an ephemeris of the comet's place for the next five or six weeks; and this is not always forthcoming. An approximate orbit is indeed usually calculated by the time a comet has been in sight for a week, and its motion predicted by the end of this for two or three weeks more. But these preliminary orbits are often not very accurate. The difficulty may be illustrated by that of finding the exact size and position of a circle which passes through three points, *A*, *B*, and *C*, close together, and nearly but not quite in line.

If we suppose that the position of the point *B* has been observed, and that a slight error has been made placing it at *B'* instead of its real position, our calculations will lead us to the circle *A B' C D'* instead of the correct circle, *A B C D*. Within the region covered by the original observations, the two circles will be quite close together, but outside this region they will deviate from one another at an ever-increasing rate.

The mathematical processes involved in calculating a comet's orbit are closely analogous to this simple case, though much more complicated. It is, therefore, easy to see that a small error in one of the observed positions of the comet, on which the calculations are based, may give rise to an enormously greater error when the attempt is made to predict, by means of these calculations, where the comet will be after an interval of time ten times as great, or more, than that covered by the original observations.

It is therefore not worth while to use the preliminary orbit of a comet to predict its motion for more than two or three weeks. Before the end of this time, many more observations can be secured, and an improved determination of the orbit made (just as, in our diagram, it is evident that, if we had observed the positions of two or three mere points on the circle between *C* and *D*, even with errors as large as that made in the case of point *B*, the whole set of such observations would suffice to fix the position of the true circle with considerable accuracy).

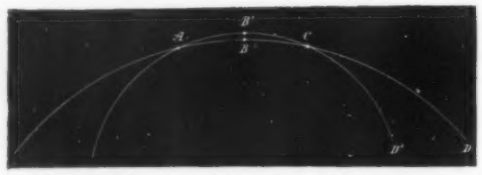
For these reasons it is the exception, rather than the rule, when an ephemeris predicting a comet's position till the end of a given month is available by the 15th or 20th of the preceding month; and this explains why the predictions concerning newly discovered comets, appearing in these columns, may sometimes appear vague.

Brooks's comet, mentioned last month, is a case in point. In this instance, too, the early estimates of brightness seem to have been too low. The comet has not only become visible to the naked eye, but fairly conspicuous.

Its orbit is now pretty well determined, perihelion passage occurring near the end of October, at a distance of some 40 million miles from the sun.

During the early days of the month it will be visible in the evening sky, though the moon, then in her second quarter, will interfere with observation. There ought, however, to be no difficulty in identifying the large diffuse head of the comet with a field-glass.

Later in the month it passes between the pole and the sun, and for a few days will be visible both in the evening and the morning, low in the northwest after dark, and low in the northeast before dawn. At the time of perihelion, toward the end of the month, it will be in Virgo, rising more than two hours before the sun, and should be a fairly conspicuous object after new moon, when the morning skies are dark.



Slight shift of B makes very different curve

THE HEAVENS.

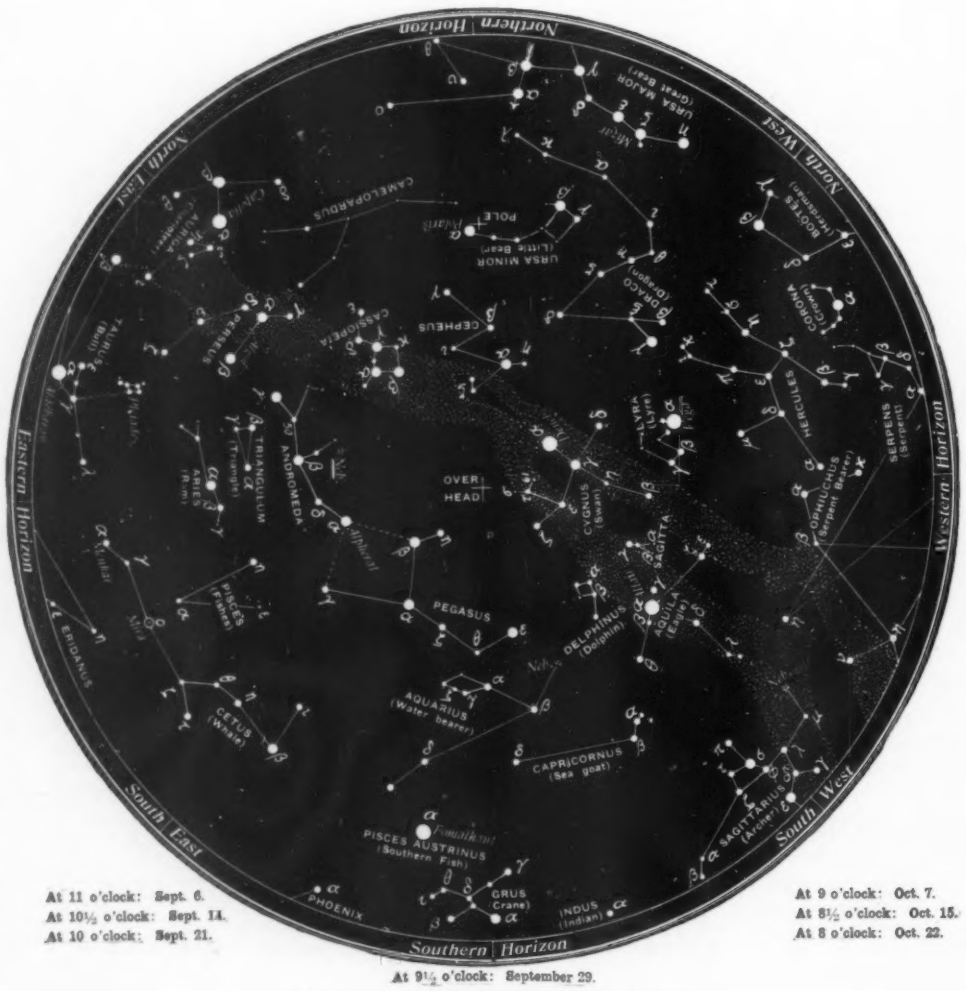
At the hour for which our map portrays the appearance of the sky the Milky Way forms a vast arch passing almost through the zenith. Along this are many fine constellations—Sagittarius, low in the southwest; Aquila, well up in the same quarter; Cygnus, almost overhead, but a little west of the zenith; Lyra, west of this; Cassiopeia, high in the northeast; the less conspicuous Cepheus, just above the Pole star; Perseus, at a moderate altitude in the northeast; and finally Auriga, just rising below him.

The Great Bear is low on the northwestern horizon, and the Dragon, coiling around the Little Bear, is higher up. Boötes has almost set in the northwest, and Corona is very low. Hercules is a little higher, on the way toward Lyra. Ophiuchus and Serpens are also represented by only a few stars in the west.

Capricornus and Aquarius fill a large, dull region in the southern sky. Below them is an isolated star, which from its very loneliness seems all the brighter. This is Fomalhaut, the only conspicuous object in the constellation of the Southern Fish. A nearby horizontal line of five stars of the fourth magnitude, not shown on our map, but visible easily enough on a clear night, form the remainder of the constellation.

Fomalhaut is of some interest as being within a measurable distance, though not one of the very nearest stars. Its parallax is 0.14 second, corresponding to a distance of 26 light years, and its actual brightness is about fifteen times that of the sun.

Below Fomalhaut, and now on the meridian, is the far southern group of Grus, the Crane. Its two brightest stars, of the second magnitude, barely rise above the horizon of New York, but it is a conspicuous constellation in lower latitudes. The great square of Pegasus is close to the zenith, on the southeast. Andromeda is just to the left with Triangulum and Aries below her. Taurus is rising, a little north of east. Cetus and Pisces fill the southeastern sky.



At 11 o'clock: Sept. 6.
At 10½ o'clock: Sept. 14.
At 10 o'clock: Sept. 21.

At 9 o'clock: Oct. 7.
At 8½ o'clock: Oct. 15.
At 8 o'clock: Oct. 22.

At 9½ o'clock: September 29.

NIGHT SKY: SEPTEMBER AND OCTOBER

THE PLANETS.

Mercury is morning star until the 23rd when he passes behind the sun, and becomes evening star. He rises about an hour and a quarter earlier than the sun at the beginning of the month, and should be fairly easy to see. By the 15th he is lost in the sun's rays, and remans so until November is half over.

Venus is likewise a morning star, but is much farther from the sun, and exceedingly conspicuous—reaching her greatest brilliancy on the 21st. She rises about 4:15 A. M. on the 1st, and just before 3 A. M. on the 31st. At 1 P. M. on the 18th she is in conjunction with the moon. Though 7½ degrees south of the latter, she can then be easily found with the naked eye—her great brightness making her clearly visible, even at noon.

Mars is in Taurus, not far from Aldebaran, rising about 8:30 P. M. on the 1st, and 6:30 on the 31st. He is steadily approaching the earth, and by the end of the month is less than fifty million miles distant, which makes him appear very bright.

Jupiter is evening star at the beginning of the month, setting about 7 P. M., and too near the sun to be easily seen. As he passes through conjunction on the 23rd, he is practically invisible later in the month. Saturn is in Aries, approaching opposition. He rises before 7 P. M. in the middle of the month, and is well seen before midnight.

Uranus is in quadrature with the sun on the 19th, and can be observed in the west in the early evening. Neptune is in a similar configuration, on the other side of the sun, on the 17th, and is visible in the morning sky.

The moon is full at 11 P. M. on October 7th, in her last quarter at 7 P. M. on the 14th, new at 11 P. M. on the 21st, and in her first quarter at 2 A. M. on the 30th. She is nearest us on the 11th, and farthest away on the 27th. The present new moon is marked by an annular eclipse of the sun, visible along a tract passing from the Aral Sea through Turkestan, Tibet, and southern China, thence through the southern part of the Philippines, and over New Guinea. As a partial eclipse it will be visible over all southern Asia and Australasia from India to Siberia, and from Japan to southern Australia.

Besides the conjunction with Venus on the 18th, already mentioned, the moon passes near Saturn on the 10th, Mars on the 11th, Neptune on the 14th, Mercury on the 21st, Jupiter on the 23rd, and Uranus on the 29th, none of the observable conjunctions being close.

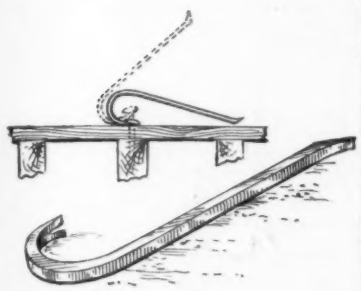
Princeton University Observatory.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

A Goose-neck

ONE of the handiest tools in working around a house or small shop is a goose-neck, such as shown in the accompanying sketch. It is practically a small crowbar, pointed at one end to form a pinch bar and returned at the other end to form a claw which can be used for



A goose-neck.

pulling nails or small spikes. It is easily made, inexpensive, can be used in many ways and will be found especially useful in moving stones or other heavy objects, prying timbers apart, opening boxes, wrecking small buildings and in a hundred other ways in which a small, easily handled crowbar can be used to advantage.

A New Range Finder

THE accompanying illustrations convey a very fair idea of the appearance of the Barr and Stroud range finder, at present used in the British army and now undergoing a series of tests by officers of the United States army, stationed at Fort Sam Houston, Texas, with the view of determining what advantages, if any, it possesses over the Weldon instrument as used by our own government.

The principal claims of superiority of the Barr-Stroud finder over other instruments of similar nature are its portability, absence of all delicate mechanism, ease of manipulation and the fact that it obviates all necessity of the services of more than one man to establish a measured base.

The invention of the range finder was the outcome of a public advertisement, issued by the British War Office in 1888, for an instrument which would fulfill certain specified conditions.

In the working out of the design for the finder it was sought to make the accuracy of the instrument, so far as possible, independent of the precision of such mechanical parts as micrometer screws or any delicate mechanism which might become worn or deranged through hard continued service. This has been accomplished by the employment of a translatable deflecting prism to which the scale is directly attached.

As originally produced, however, the range finder fell far short of fulfilling expectations, due principally to the difficulty of making the optical parts, which are of exceedingly novel design. It was only within the past few years, when the quality of optical glass procurable had reached such a state of perfection, that the instrument was accepted.

In construction, the range finder consists of two telescopes of twelve powers each incorporated in a common tube, something over two inches in diameter, leather covered and closed at both ends.

The light through each telescope is admitted through a square-shaped aperture near each end of the barrel, the lenses contained therein being protected from dust and other injury by a steel sleeve rotating over the aperture. The light admitted through these apertures is directed by means of reflectors along the inside of the tube to the eye-piece.

The whole arrangement is such that the combined telescopes may be simultaneously directed on the same target, the range finder forming the base of the triangle, having at its vertex the object, the range of which is determined by measuring the parallax.

The operation is exceedingly simple. To make an observation the observer grasps the handles and directs the instrument toward the object whose distance is to be ascertained, holding the range finder horizontal with the line of object.

In the right eye-piece are placed two mirrors separated by an extremely narrow horizontal line. Supposing the object selected is a flag staff, the picture presented to the observer will be that of a broken column the upper part of which has been moved to the left.

In the case of looking at a tall building, the picture shown resembles nothing more than one brick overlapping another.

This distortion is due to the lack of coincident focus between the two telescopes; that portion of the image shown in the upper half of the field having been formed by the left hand telescope, while the lower portion of the image is formed by the right hand telescope.

The next procedure is to bring these broken lines into plumb, which is accomplished by means of a large screw having a milled head placed near the tripod head and so situated that it may easily be manipulated by the thumb and forefinger of the right hand while grasping the handle. This screw, when turned to the right, causes the upper half of the image to move to the left and its parts to separate; when the screw is turned to the left the two halves of the image are brought together, so that the perpendicular lines coincide at the dividing horizontal line and all distortion disappears.

When this is done the correct distance may be read through the left eye-piece, where a series of figures in yards appear on the surface of a wide disk, the scale having moved according to the direction in which the operating screw head was turned.

It will be seen therefore that the correct range always depends upon bringing the two halves of the image into exact alignment at the line separating the two mirrors.

The advantages claimed for the finder are:

First. Only one observer required.

Second. The range of moving objects can be continuously observed.

Third. It is not essential in the types suitable for infantry and cavalry that the instrument be level when taking observations.

Fourth. It can be used at night to take the range of distant lights.

Fifth. Rapidity of operation—30 seconds or less being all the time required for determining a range.

Sixth. It can be used from cover and from a prone position so that the observer's whereabouts are not disclosed to the enemy.

These range finders are made in sizes varying from those having 15 and 12 foot bases, for use on ship board and in sea coast forts, to an instrument with a 4 foot 6 inch base, for field artillery, down to those intended for infantry and cavalry, having bases of only 32 and 26 inches.

It is the last and most portable model which may be carried in a case and slung over the shoulders that officers are now experimenting with at Fort Sam Houston.

Its length over all is only 30 inches and its weight 7¼ pounds.

The instrument may be used mounted on a light tripod or it may be used while standing erect with the aid of a light steel rod, the base of which rests in a socket carried in a belt and supported by shoulder braces, or by lying in a prone position upon the ground.

The claims as to ease of manipulation coupled with accuracy appear to be well founded. Upon one day of the tests a civilian spectator was asked to find the range of a building, distant nearly three miles. Within about 15 seconds he announced a result, which was only 140 feet out of the way, according to the calculations made by Col. Brown himself. Another spectator, measuring the distance across the parade grounds to the barracks, gave the correct reading (392 yards) at the first attempt.

Mounted on a tripod.

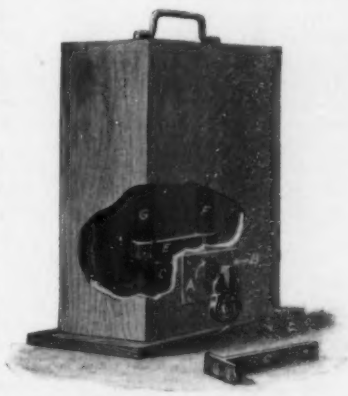
Supported from a belt at the waist.

The range finder in use.

A NEW RANGE FINDER

A Gasoline Tank and Pump for Automobilists

MANY automobile users install gasoline tanks with pumps, in their yards, adjacent to their private garages. In some places the local fire regulations require that the tanks, when installed, be located a given number of feet from any building. The writer's attention was called to a cover and guard for the pumping devices of such a tank which protects the pump and prevents any unauthorized person from tampering with it. It consists of a box, open at the bottom and of such size and shape



A gasoline tank and pump for automobilists.

as to fit over the pump. Near the bottom of the box are two opposite slots, *A*, reinforced by metal plates *B* and a bolt *C*, with a head at one end; an opening near its other end is passed through the slots *A* and secured by a padlock. This bolt *C* passes when the box is fitted over the pump below a bar *E* which extends between the filling pipe *F* and the dispensing or pump pipe *G* of pumps of the Bowser type, and so locks the guard box over the pump. The box, such as shown, has been in actual use for several months and has proven satisfactory in every respect.

Notes for Inventors

Cloth Pinions.—Cloth pinions are highly successful devices for reducing the noise and increasing the life of power transmission gearing. Metallic gearing, especially steel, is always more or less noisy in operation, the noise becoming particularly troublesome in the case of high speed gear trains. Furthermore, iron or brass gearing has not sufficient elasticity to successfully withstand the shocks or back lash caused by the torque variations incident to the operation of machine tools such as punches, shears, planers, etc. In order to overcome these drawbacks, various kinds of nonmetallic substances, such as rawhide and paper, have been used instead of brass and cast iron for one or more members of gear trains, but the results have been only partially successful. As a rule pinions made of such substances were not sufficiently impervious to moisture or unaffected by exposure to heat, and in the case of rawhide were liable to injury by rats and mice when kept in stock. In the cloth pinions developed by a prominent electric company, these defects are entirely eliminated, both by the nature of the material and the method of construction employed. The blanks from which the pinions are cut consist of a filler of cotton or similar material confined, at a pressure of several tons to the square inch, between steel "shrouds" or side plates, the whole structure being held together by means of rivets, or, in case of very small pinions, by threaded sleeves. After the teeth are cut, the cloth filler is impregnated with oil. Cloth pinions are entirely impervious to moisture, unaffected by changes in atmospheric conditions, and absolutely vermin proof. Cloth pinions have a wide range of application. They are particularly suitable for use on the shafts of back

geared motors employed for driving lathes, planers, drill presses, shears, punches, and other machine tools; for loom and spinning frame drive in cotton, silk, worsted, carpet, and textile mills in general; for operating pulp and paper mill machinery; for driving printing presses, and for the valve, ignition and timing gear trains of automobile and other types of internal combustion engine.

The Deplorable Fertility of the American Inventor.—At a recent meeting of the National Electric Supply Jobbers, an address was made by one of the members, deploring the fertility of the American inventor, which, it is claimed, makes material antiquated before it can be disposed of by sale. It is necessary to purchase material in quantities in order to get much of a profit, but before this can be disposed of there are new devices and features on the market which are preferred to earlier patterns. Why not devise a new selling system instead of damning the inventor? Perhaps some thoughtful inventor will help this human back-number out.

Another Lamp Filament Patent.—Carl Auer von Welsbach has just secured a patent on the manufacture of electric lamp filaments. The process provides for eliminating the gases occluded in filament containing a metallic oxid and osmium by slowly bringing the filament up to a temperature sufficient to drive off the gases, but below the reduction temperature of the oxid, and finally increasing the temperature to white incandescence, and partially reducing the oxid.

Recent Reissues.—On August 15th, 1911, four reissue patents were granted. In all four cases the reissues issued to assignees and the assignee in each case is a corporation

Battle Creek Patent Foods.—Three patents, No. 1,001,044, 1,001,045, 1,001,149, for food compounds, and one patent, No. 1,001,050, for a food product, have been issued to Dr. John H. Kellogg of Battle Creek, Mich. The compound of the first patent includes gluten, legumes and yeast products, while the second substitutes nuts for the legumes, the compound in each case being cooked into a homogeneous mixture of fibrous consistency and meat-like flavor. The compound in patent No. 1,001,149 includes gluten, potato and yeast products, while the patent 1,001,050 combines casein, gluten, oil and a yeast product, the mixture in each case having a meat-like flavor.

Another Ozone Patent.—The distribution of ozone is the object of an apparatus patented, No. 1,001,038, to Frederic Georg Janich of Rheydt, Germany, assignor to Otto von Mühlmann of Brussels. The apparatus comprises an ozonizer with a discharge conduit opening in front of the blades of a fan, with a funnel-shaped screen between the blades and the discharge conduit, a second screen being fitted to and spaced from the first screen and the conduit opening into the space between the screens.

Blowing Bad Breath Away From the Dentist.—A dental appliance, providing means whereby a flat blast of air will be delivered between the face of the patient and that of the operator, thereby preventing each from inhaling the other's breath, has been patented, No. 1,001,362, to Charles W. Davidson of Jefferson City, Mo.

A Woman Inventor.—Women frequently invent devices for domestic use. This is true in the case of Mary M. Clarke of Des Moines, Iowa, who has secured a patent, No. 1,000,073, for a fish-scaling tool which has a handled scraper with a reticulated or wire screen guard extending in both directions beyond the scraper, the latter being shown as formed with a number of serrated scraping blades.

Col. Krag in America.—Col. Krag of Norway, inventor of the celebrated Krag rifle, is making an extended visit to this country and called at the Patent Office in Washington and was shown the interesting features of that branch of the government. The great inventor is a man apparently in the sixties, well preserved, and is greatly delighted with the courtesy and the hospitalities which have been extended to him.

The Government Advertises a Patent.—It is not often that a government publication exploits and advertises the sale of a patent, but a recent government publication, after describing an invention somewhat in detail, concludes with the following paragraph: "The inventor is on the point of selling his French rights in the invention, and application has been made for a United States patent. The experiments were witnessed by the editors of the three Havre daily newspapers, several members of the municipal council, and other authorities who signed a certificate of proof. A sample of the new..... will be loaned to interested firms which apply to the (giving here the name of the government office)."

Synchronously Operated Musical Instruments.—Samuel S. Waters of Washington, D. C., has patented, No. 1,002,100, means for synchronously operating two musical instruments, in which a movable record for one instrument moves a member at a proportional speed and the record for the other instrument is caused by said member to move at all times at a speed proportional to the speed of the record of the first machine. The patent is assigned to the Aeolian Company of New York city.

A Stand for Assembling Automobiles.—A stand for assembling vehicles, such as automobiles, has been patented, No. 1,001,619, to Howard E. Coffin of Detroit, Mich., and includes means for supporting the axles and the main elements of the frame separately and in their normal relative positions and means for lowering the support to disengage it from the assembled vehicle to rest the latter on its wheels so the vehicle, when assembled, can move off on its own wheels.

General Electric Company Patents.—Among the patents issued August 29th, 1911, were eleven issued to the General Electric Company, the inventors including Elihu Thomson, Conrad Baumgardner, Fred B. Corey, Allen A. Tirrill, Howard K. Sargent and Kennett F. Kingwell.

A New Pavement.—We do not always realize that the pavements we walk or ride on may be patented. A patent, No. 1,001,695, to August E. Schutte of Newton, Mass., is for a pavement consisting of a layer composed of stone, coated and cemented together with relatively pure Portland cement, with the spaces between the coated stones filled with bituminous cement.

A Gas-driven Locomotive.—In a locomotive patented, No. 1,001,703, by Arnold Stucki of Allegheny, Penna., is provided a suitable unit frame, carried by the locomotive wheels, and this frame is provided with a continuous gas-producing apparatus and with an internal combustion engine, connected with the producer, adapted to drive the locomotive wheels. An air pump is also carried by the unit frame and is adapted to start the engine.

A Queer Coffee Pot.—In patent No. 1,002,819, to Franklin V. Brooks of New York city, is shown a coffee-making device in which a coffee pot and a boiler, side by side, are pivoted so they can swing to bring one or the other over a heating lamp. The boiler is held over the lamp until the water is transferred from the boiler to the coffee pot, when the weight of the water will operate automatically to swing the coffee pot to a position over the lamp.

A New Kind of Box Kite.—Patent No. 1,003,062 has been issued to Albert O. Paulson of Los Angeles, Cal., for an air ship characterized by a pair of box kites fore and aft and connected together and mounted with an edge at the top and bottom and having the lower corners cut away to admit air. Horizontal sustaining surfaces are provided on each kite.

Making Flour by Steam.—A new process of making flour or meal is presented in the patent, No. 1,002,990, to Charles Herendeen of Chicago, in which steam is injected into a mass of cereal to disrupt the starch cells, after which the mass is dried by passing it through blasts of air, and is then ground into flour or meal of any fineness.

A Novel Amusement Device.—William C. Sanford of Kent, Wash., has patented, No. 1,002,874, an amusement device in the form of a transparent barrel having a visible outlet, and an invisible outlet by which the receptacle may be emptied while the visible outlet is closed. The barrel is suspended by a number of lines and one of the lines is hollow and connects at one end with the invisible outlet, while its other end leads to a suction pump, placed out of sight, and which can be operated to pump the contents of the barrel.

An Automatic Pile Cleaner.—For protecting piles, Charles N. Hubbard of Anacortes, Wash., provides in a patent, No. 1,002,847, a float, surrounding the pile so it will rise and fall with the tide, and a brush is connected with the float so it will move along and brush the pile as the float moves up and down. A quantity of a suitable preservative is carried by the float and conducted by pipes to the brush so it can be distributed to the surface of the pile.

A New Twist Drill.—The Hoefer Manufacturing Company of Freeport, Ill., as assignee of Frederick W. Hoefer, has secured a patent, No. 1,002,846, for a twist drill whose shank is twisted alternately in opposite directions, the shank being so twisted from a flat bar.

Legal Notes

Conflict Between Commissioner's Decision and Bill in Equity.—The Assistant Commissioner of Patents, Mr. Tennant, has decided in the case of McIntyre v. Perry that where, after a decision on priority by the Court of Appeals of the District of Columbia, the defeated party files a bill in equity under the provisions of section 4915 Revised Statutes, the filing of such bill does not operate as a *supersedeas* of the judgment and that the issuance of the patent to the party who succeeded before the Court of Appeals cannot be suspended pending the final determination of the suit.

Invention Completed in a Foreign Country.—In affirming the decision of the Commissioner of Patents in the case of De Kando v. Armstrong, the Court of Appeals of the District of Columbia has decided that where a party completed the invention in issue in a foreign country and knowledge of such invention was brought into this country and disclosed to others, the foreign inventor can derive no benefit from the work done in such foreign country and the disclosure of the invention to others in this country is not equivalent to a reduction to practice of the invention, but is merely evidence of conception thereof. In concluding his decision, Mr. Justice Van Orsdel says:

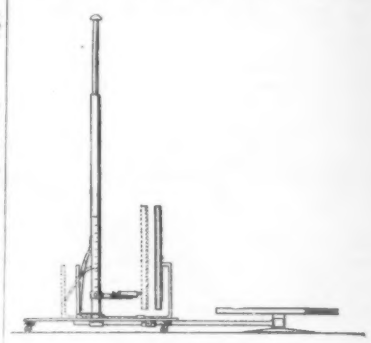
"The right of appellee to a patent cannot be superseded by any act of appellant's short of a reduction to practice prior to appellee's filing date. Had his foreign invention been reduced to practice here prior to that date, appellee's conceded lack of diligence would have been sufficient to have entitled appellant to the award of priority, but, inasmuch as his reduction to practice abroad cannot be considered, appellee must be regarded as the prior inventor."

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

SKIRT MEASURER.—MRS. ROSE N. FIRESTONE, Anthony, Kan. The object of this invention is to provide a skirt measurer and marker, by means of which the wearer may measure and mark the desired length of her own skirt, without assistance, and without the necessity of bending over, or disarranging the hang of the garment. The illustration shows a side view of the improvement. Means



SKIRT MEASURER.

provide for the skirt being brought against the marking material which results in the making of a transverse mark on the skirt. The skirt is brought back to first position and the wearer then revolves the platform the desired distance, and makes another mark on the skirt. This process continues until the measuring and marking is completed.

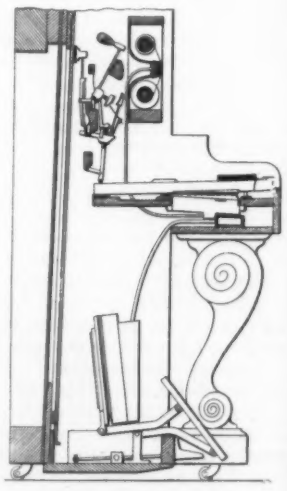
Of Interest to Farmers.

BUTTER AND MILK MIXER.—C. T. BARTON, Buffalo, N. Y. In operation a quantity of butter and milk is first placed in the body of the apparatus, the proportions being preferably a pint of milk to a pound of butter, and the dasher is then operated for the purpose of cutting up the butter and working them together, so as to merge them and form practically one substance, or a butter compound which becomes solid the same as butter proper.

Of General Interest.

FERTILIZING SCALE POISON.—W. R. KLECKNER, Bay City, Mich. This poison destroys all kinds of parasitical insects infesting various parts of fruit, forest and ornamental trees or shrubs and vines, and, further, operates to discharge food products directly into the sap, supplying an immediate stimulation and fertilization of all tissues and growing parts of trees, quickly correcting the failing activity and low vitality caused by the ravages of parasitical insects or by depleted and unsatisfactory soils.

PNEUMATIC PIANO PLAYER.—WILLIAM G. MACARTHUR, 428 E. 148th St., New York, N. Y. This invention relates to an improved piano-player, an accompanying illustration of which shows it in a vertical section through a piano with the attachment thereon. An object of the invention is to provide a device which



PNEUMATIC PIANO PLAYER.

will be inexpensive to manufacture, strong, durable and both quick and positive in its action. A further object is the provision of a piano playing attachment in which the pneumatic portion of operating mechanism is attached directly to the keys, whereby a great saving in space and more positive and sensitive movement is obtained.

PROCESS OF PICKLING.—A. BAUMANN, New York, N. Y. This process is for use in making edible and easily digestible salt pickles from green cucumbers, in a simple and economical manner, and reducing the loss of pickles, that usually become hollow and soft, to a minimum. The process subjects green cucumbers to the action of a brine formed of dissolved common salt, chemically pure hydrochloric acid and soda benzoate.

PILE PROTECTOR.—C. N. HUBBARD, Anacortes, Wash. The particular object of this device over that shown in the former patent granted to Mr. Hubbard, is to provide a pile protector so constructed that the chemical compound used in protecting the pile may be carried to a greater depth than low tide, whereby the extermination of teredo and limnoria and other marine worms is facilitated.

STAMP HANDLING DEVICE.—R. W. JONES, Lincoln, Neb. This improvement has reference more particularly to a device comprising a casing constituting a magazine for the stamps, a guide member associated with the magazine and adapted to have the stamps passed along it manually, from the casing to the point of application of the stamps, and a moistening device for wetting the adhesive of the stamps before they are applied.

TRAP.—T. H. TAYLOR, Luzerne, N. Y. The intention here is to provide a trap for trapping animals. Use is made of a fixed toothed jaw constituting a base, a swinging jaw mounted on the toothed jaw, a tripping rod for engagement with the swinging jaw, and a tripping plate on the fixed jaw and adapted to be releasably engaged by the tripping rod.

COUPLING FOR REINFORCED CONCRETE PIPES.—C. H. WILSON, Red Oak, Iowa. An object of this inventor is to provide a means for uniting two pipe sections together in such a manner that there will be a positive and tight joint between the different sections, and it has for a further object the disposition of this coupling means so that they are not exposed to the weather and are thereby protected from any rusting action.

FORM FOR PRODUCING ARTIFICIAL TOOTH CROWNS.—E. R. STEVENSON, Oakland, Ore. In this case the improved tooth form being hollow is adapted to receive a plug or other device adapted for expanding it, and thus, by using different sized plugs or expanding devices, the form may be enlarged circumferentially so that several sizes of crowns may be produced by means of one form, and also the shape of the form may be changed to a certain extent, by using plugs differing more or less in contour.

BAKER'S OVEN ATTACHMENT.—R. L. GILLISPIE, New York, N. Y. In this instance the improvement pertains to an attachment for a baker's oven, in the form of an inlet, whereby access may be had to the interior of the oven in a most convenient and readily accessible manner by means which can be readily controlled, and which will be simple and inexpensive.

GUN LICENSE CERTIFICATE HOLDER.—O. R. DUNCAN, Jefferson, Iowa. The purpose here is to provide a license certificate holding receptacle which is attached to the gun so that the hunter may be certain to have the license certificate with him every time he takes his gun to go hunting. The receptacle is attached to the barrel by a clamp having two arms which are curved and are disposed against the outer side of the barrel or barrels, the clamp arms being held against the gun barrels by a screw member.

ATTACHMENT FOR TRIAL FRAMES.—G. A. GRIFFIN, New York, N. Y. The aim here is to furnish an attachment for supporting a smaller lens substantially parallel to the trial lenses and adjacent the lower portion thereof, so that the eyes may be tested both for long distance and for reading at the same time, and the patient may know the advantages and operation of using a bifocal lens rather than having separate pairs of eyeglasses or spectacles for general use and for reading.

Hardware and Tools.

PICK.—J. E. CARTER, Reno, Nevada. Among the principal objects which the present invention has in view are: To provide a construction and arrangement of a pick to facilitate the replacement of steel points, and to provide a construction and arrangement which renders possible the carriage of a supply of renewing pick points adapted for attachment to the pick body or eye.

MITER BOX.—J. G. WORTHAM, Tullahoma, Tenn. This box consists of a bed, which may be widened or narrowed to conform with the dimensions of the work, a swinging arm supporting and carrying the saw guide, and capable of being lengthened and shortened, to correspond with the positions of the bed sections, and an adjustable back, together with a scale for indicating angles assumed by the arm.

DUST PREVENTER FOR STONEWORKING TOOLS.—W. M. HOLDEN and E. M. TOBIN, Barre, Vt. To avoid several objections this invention is devised, and consists of a fluid discharge pipe having an extended atomizing outlet, and a liquid supply member arranged to discharge on the said outlet, the above pipe ordinarily leading from the exhaust of the tube, with the extended atomizing outlet of spoon form.

PENCIL HOLDER.—A. B. COFFIN, Apache, Okla. Among the principal objects which the present invention has in view are: to provide a simple, economical and efficient form of pencil holder for pencils, fountain pens, and articles of a similar character; and to provide a holder light in construction and adapted for easy attachment to the clothing of the user.

LOCK.—Y. Q. CALDWELL, Paris, Tenn. Although the form of this device is that of a padlock, it may be utilized in other forms of locks such as trunk locks, or similar devices. An object of the invention is to provide a device strong and durable, because it consists of relatively few parts. Owing to its peculiar construction it is difficult to pick, and the parts may be easily assembled or disassociated.

HASP LOCK.—Y. Q. CALDWELL, Paris, Tenn. An object of this improvement is the provision of a combined lock and hasp, which does away with the necessity of the use of a padlock or other means for securing the hasp to the staple. It is in the simplicity of the lock and the elimination of a multiplicity of parts that the merit of this invention lies, as well as in the fact that these few parts are strong and durable and are not liable to get out of order.

Heating and Lighting.

JOINT AND COUPLING.—B. W. STOUFFER, Pittsburgh, Pa. This improvement provides a joint and coupling, more especially designed for use as a swing joint, socket joint, coupling or other gas fixture, and arranged to permit of conveniently placing the joint or coupling in position on any desired fixture without the aid of tools and without danger of leakage or the parts becoming accidentally disassembled or separated.

Household Utilities.

DUMB-WAITER.—E. N. HALLETT, Canton, Pa. In this case the invention provides a pantry closet on a dumb-waiter so that when food is placed on the shelves of the closet the dumb-waiter may be lowered through an opening in the floor of the kitchen to the cool air of the cellar. A supporting frame is constructed on the waiter so that when it is lowered with the frame, the working parts are disposed below the floor of the kitchen.

VENTILATOR.—W. F. GULNERICH, Meriden, Conn. This invention has for its principal objects to provide a ventilator adapted to be attached to a window, and to permit the ingress of air into the interior of a building without causing a draft, at the same time keeping out all objectionable foreign matters and substances, and to provide such a ventilation with means for regulating the influx of air to the desired extent.

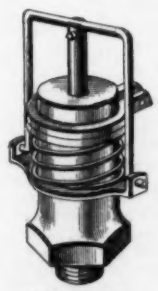
Machines and Mechanical Devices.

WAVE MOTOR.—A. W. DOWE, Camden, N. J. This invention provides means to avoid the destructive operation of the elements incidental to storms; provides a construction which receives and transmits the full dynamic power of the surf or waves at the shore line; and provides a machine the power or full efficiency of which may be augmented to a large degree by multiplying the motor units indefinitely.

HINGE MECHANISM FOR THE COVERS OF LOOSE LEAF BOOKS.—F. L. IMPEY, 19 Barwick Street, Birmingham, England. This mechanism is for use on leaf books or binders of the type in which the covers are pivotally connected at their rear edges to clamping bars by which the leaves are bound in position, the covers being connected together by leather thongs, which pass through the clamping bars and are tightened or released for securing or liberating the leaves by mechanism arranged within one or both of the covers.

WELL DIGGING APPARATUS.—C. B. MARTIN, Portland, Ore. The invention refers to apparatus for digging wells, and for forming bores in the earth, and has reference more particularly to apparatus comprising a casing adapted to be advanced to the core as it is formed, a drill head associated with the casing and means for conducting fluid pressure to the drill head to cause it to advance into the earth.

GREASE CUP.—FRANK L. TREESE, care of R. S. HAULEY, 1808 11th Ave., Altoona, Pa. An object of this invention is to provide a cup for holding hard grease of a semi-fluid nature with means for forcing the grease through a feed opening. A further object is to provide a device which may be readily filled and in which



GREASE CUP.

the cover forms a guide member for the stem of a movable plunger or piston. Again, the aim is to provide a cup of maximum capacity, owing to the fact that part of the mechanism for exerting a pressure on the grease is disposed on the exterior of the cup rather than on the interior. The illustration gives a perspective view of the device in operative position.

ADVERTISING DEVICE.—H. R. KIESSIG, Sacramento, Cal. The object here is to provide a device for continuously operating that class of advertising devices known as "Chinese puzzles," or "Jacob's ladders," and consisting of a plurality of plates or panels, so connected that when the topmost panel is severed, the other panels will be reversed in succession from above downward.

VENDING MACHINE.—C. S. HARDY, San Diego, Cal. The purpose of the invention is the provision of a device which will dispense accurately measured quantities of liquid, without the necessity of an attendant, and which will be operated by the liquid, under pressure. A further object is to provide a device wherein the amount dispensed may be varied, by varying the capacity of the pump.

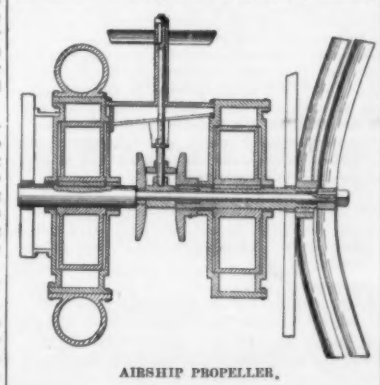
DEVICE FOR ELEVATING WATER, MERCURY, OR OTHER LIQUIDS.—JAMES R. HALL, Winnfield, La. This invention relates to means for raising water, mercury or other liquids to a higher level. It is an improvement over that disclosed in a prior application of Mr. Hall. The main object of the present invention is to increase the turning effect by the use of impact wheels instead of troughs, the motion of the wheels being communicated to the revolving frame so as to increase the rotative movement of the latter.

MACHINE FOR EXTRACTING ESSENTIAL OILS FROM CITRUS FRUITS.—WALTER A. D. ALLPORT and THOMAS J. W. C. DAVENPORT, Roseau, Dominica, British West Indies. This invention provides a machine for extracting essential oils from the outer rind of citrus fruits, such as lemons, oranges, limes, etc., and arranged to insure a continuous operation, thus permitting the handling of a large number of fruits in a given time, and insuring complete extraction and gathering of the oil without injury to the fruits.

VACUUM STOCK THICKENING AND WASHING MACHINE.—T. E. WARREN, Ticonderoga, N. Y. This invention pertains to paper-making machinery. The aim is to provide a thickening and machine arranged to separate water from fibrous material without the loss of the finer fibers and other minute particles, to produce a stock of uniform consistency and to permit convenient adjustment for producing a stock of a thicker or a thinner consistency, according to the nature of the fibrous material to be treated.

STOP VALVE AND TAP.—J. T. SHELDON, "Olgate," Fernhill Street, Fernhill, New South Wales, Australia. The purpose of the inventor is to provide a simple and effective means of preventing the escape of water, steam or other fluid normally controlled by a valve, when the cover thereof is removed, in order that the internal parts and mechanism may be withdrawn for examination, replacement or repair.

AIRSHIP PROPELLER.—HOMER A. KING, P. O. Box 474, Colton, Cal. The invention illustrated by the accompanying engraving has for an object the provision of a novel form of propeller having a double set of blades, one set mounted on a rod and the other set mounted on a sleeve carried by the rod, the propellers being oppositely inclined, and being



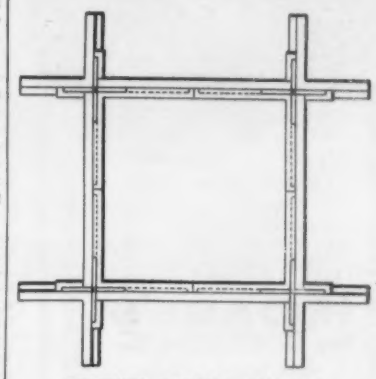
AIRSHIP PROPELLER.

arranged to revolve in opposite directions. A further object is to provide an auxiliary propeller, which is designed to give a motion at right angles to the first named propellers. Another object is to provide means for operating the propellers simultaneously, and for throwing the auxiliary propeller out of gear when desired.

DRESSER FOR BAND SAWS.—F. P. SMITH, Baypoint, Cal. This improvement provides an attachment to the usual grinding machine, the operation of which results in removing the burr at the edge of the face of the teeth, and to reduce the teeth to the same spread; provides means for dressing the sides of the teeth subsequent to grinding, and to accomplish the same automatically, and to shape the sides of the teeth to conform with the set thereof, and provides means for regulating the pitch and spread of the grinding members.

Railways and Their Accessories.

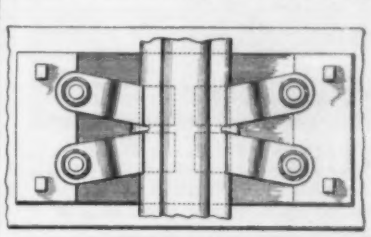
NOISELESS RAILROAD CROSSING.—ALFRED D. DANZIGER, 204 Carondelet Street, New Orleans, La. GEORGE GUILBAULT, inventor. Where two railroad tracks cross each other it is necessary to channel the upper bearing portions of the rails in order to permit the car wheel flanges to pass over. The wheels cause noise and shocks or blows on all the parts, which loosens the connections. The invention



NOISELESS RAILROAD CROSSING.

overcomes these objections by providing each rail adjacent the point of intersection with a pivoted lever, there being a pair of intersecting levers at the intersection of two rails. A bell-crank lever is pivoted to each first-mentioned lever as in operative relation with a sliding block adapted to engagement with the other intersecting lever whereby the car wheels pass over the top of this lever and do not engage the channels of the rails. A railroad crossing provided with this invention is shown in the illustration.

RAIL FASTENER.—W. VANDERCOOK, JR., P. O. Box 465, Lake Charles, La. The object of this inventor is to provide a means for holding the rail to the tie, and to prevent the so-called "creeping" of the rail, due to the movement of the rolling stock over the rail and to expansion and contraction. The device may be described as consisting of a plurality of

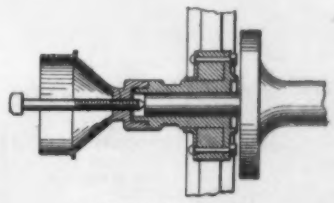


RAIL FASTENER.

pairs of gripping jaws, one member of each pair arranged one on each side of the rail, and operated by the longitudinal movement of the rail. The arrangement of ribs substantially parallel with the length of the tie, and with the grain of the tie, prevents any lateral movement of the anchor plate, and the spikes at the plate corners assist in this as do the center spikes. The engraving is a plan view of a portion of the rail provided with the improvement.

Pertaining to Vehicles.

COMBINATION PULLEY, FUNNEL, AND STRIPPING JACK.—TRESHAM F. HUTCHINGS, Stony Ford, N. Y. The principal object which the present invention has in view is to provide a device constructed to permit being used as an auxiliary pulley, a funnel for filling a water



COMBINATION PULLEY.

or gasolene tank, and means for stripping a tightened wheel from the axle bearing. The view shown in the accompanying engraving represents a vertical cross section of an automobile wheel and the axle thereof, showing a pulley constructed and arranged in accordance with the present invention as operatively connected therewith. When the pulley is not employed, it is removed from the axle, and carried as a separate tool in the body of the vehicle. It may then be used as a funnel for filling the tanks.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Better Than Nails

After fitting the corners of a picture frame or the joints of other light work, have you ever ruined the whole thing by splitting it with a nail? Then you've had need for

LE PAGE'S GLUE

For, of course, glue won't split the weakest wood. Yet a square inch of glue makes as strong a joint as three six-penny nails do.

And is just as handy as nails or string. Put up in air-tight bottles, it positively cannot dry out. The last bit you scrape from the bottle with the metal spreader is as good as the first.

With the metal spreader you can use glue in places where you couldn't use a brush, and without muss or waste.

Get a bottle today and put it with the hammer and saw. Send, too, for our booklet—"Glueism." Gives 101 uses for glue in our new bottle and patent collapsible pin sealing tube.

RUSSIA CEMENT COMPANY

We manufacture Glues (hard or liquid) in bulk for all industrial purposes.

54 Essex Avenue Gloucester, Mass.

Library Slips with every Bottle and Tube.

RUBBER Expert Manufacturers Fine Jobbing Work

PARKER, STEARNS & CO.,

288-290 Sheffield Ave., Brooklyn, N. Y.

Maxim Silencer

In use by the United States Army

Checks the muzzle blast, preventing report noise and recoil. Wonderful aid to marksmanship. Makes rifle practice possible anywhere. Attaches to any rifle. Write make, model and calibre of your rifle (giving dealer's name). We will tell you what Silencer you need, price, etc.

MAXIM SILENCER, Hartford, Conn.

The Best TOP MATERIAL

CAUTION TO PURCHASERS OF TOPS

Pantasote is a top material of recognized high and uniform quality and a product made only by us. Many unscrupulous dealers misrepresent as PANTASOTE cheap inferior materials to increase their profits—at the purchaser's expense. To the average person these substitutes when new look somewhat like Pantasote.

To prevent fraudulent substitution insist upon the label as shown above dealers receive these labels free with every yard of Pantasote, leaving no excuse for not using them.

Unlike "Mohairs" and similar products, **PANTASOTE** can readily be cleaned. It is not affected by benzine, gasoline or other cleaning fluids. In this respect it is absolutely unique and alone.

Send postal for booklet on top materials and samples

THE PANTASOTE CO. 13 Bowling Green Bldg., New York

NEW BOOKS, ETC.

HANDBUCH FUR HEER UND FLOTTE. Enzyklopädie der Kriegswissenschaften und verwandter Gebiete, herausgegeben von Georg von Alten, Generalleutnant z. D., unter Mitwirkung von mehr als 200 der bedeutendsten Fachautoritäten. Vollständig in 108 Lieferungen reichillustrierten Textes mit farbigen Beilagen, Karten, Plänen, Gefechtsskizzen usw. Deutsches Verlagshaus Bong & Co.

The financial aspects of modern warfare are considered in the present instalments, Nos. 34 and 35, of the Handbuch. Excellent tables are published, which show the rise and fall in military expenditures during the last few decades. It is particularly interesting to study the influence which actual warfare has had upon the expenditures. The whole article is a warning against thoughtless comparisons; inasmuch as all statistics are based upon different facts. In the article on the French army, a very complete and accurate description will be found of the geography of France in its relation to French military affairs, French railways and fortresses, French cable and telegraph lines, and the history of the French army. The discussion of the army itself begins with an excellent review of its development from the time of Charles V, and concludes with an exhaustive description of its present status. It enumerates the difficulties that beset the commanding officers, and shows on the basis of numerous tables, the composition of the peace and war footings; the organization of the naval arm of the service; the military budget and character of the uniforms. French naval and colonial affairs are treated in the same manner. Flying machines also find a place in these two instalments, treated, of course, from a military standpoint.

SEEING EUROPE BY AUTOMOBILE. By Lee Meriwether. New York: The Baker & Taylor Company, 1910. 12mo.; 415 pp. Price, $2 net.

The author once wrote a book on how to see Europe on fifty cents a day, but he has evidently been blessed with a change of fortune in the last quarter century, for now he travels in a two-seated, four-cylinder, 28 horsepower roadster, but the passion for traveling cheaply has been far from being quenched by comparative affluence. The author details with great precision the distances traveled and the things seen. It is an instructive book for all those who are thinking of taking the trip. There is an excellent map in the back. It is well illustrated.

CHARACTERISTICS OF EXISTING GLACIERS. By William Herbert Hobbs, Professor of Geology in the University of Michigan. New York: The Macmillan Company, 1911. 8vo.; 301 pp.; illustrated. Price, $3.25 net.

Prof. Hobbs discusses his subject under three heads, mountain glaciers, Arctic glaciers, and Antarctic glaciers. It is his contention that a mistake is made in treating of glaciers as if all were governed by the same laws. He prefers rather to emphasize the fact that the laws governing their nourishment and depletion are far from identical. The division is broadly made between those glaciers which cover completely a large portion of rock surface, having the form of a shield or flat dome, and the remaining types which may be designated as mountain glaciers. Small ice-caps occupy an intermediate and transitional position between these two types. The language and treatment is rather technical, but will well repay the slight study necessary for the layman to understand its terms. Since, as we are reminded by Sir Charles Lyell, "The present is the key to the past," the study of glacial conditions never fails to create enthusiasm and broaden the understanding.

THE SCIENCE OF CURRENCY AND CENTRALIZED BANKING. By Herbert D. Miles. New York: Rand-McNally Press, 1911. 16mo.; 47 pp.

The author is an ardent champion of the Aldrich plan, which he designates as a work of genius, profound, far-reaching, yet simple and sincere. He reviews the banking systems of the world, compares and contrasts the European credit instruments and discounts with those of the United States, and proceeds to an examination of American methods, their relation to gold reserves and their efficiency in crises. The treatise exhibits some clear thinking and much ability for condensation. It aims to give the gist of what has recently been issued by the National Monetary Commission through its various published papers.

CONCRETE MONUMENTS, MAUSOLEUMS, AND BURIAL VAULTS. By A. A. Houghton. New York: The Norman W. Henley Publishing Company, 1911. 65 pp. Price, 50 cents.

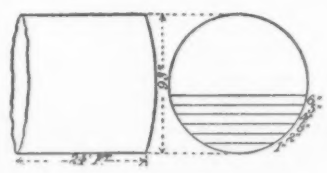
Among the new industries opened up by concrete, that of monumental work offers a large and profitable field. No. 6 of the "Concrete Worker's" series goes at length into the construction of monuments, mausoleums, and burial vaults, citing their points of advantage and giving the plainest directions for their construction. The illustrations include a variety of artistic designs.

Notes and Queries.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(12546) F. B. T. says: A short time ago I bought a barometer, which appears to be a very good instrument, but its action is a little puzzling, and I wonder if you can give me a helpful suggestion. The only time that the barometer has gone up to 30 was during the extremely wet weather we had a few days ago; and in the dry season which we experienced during the summer, it ranged around 29½ or thereabout. It has never gone much below 29 in spite of the fact that we have had some very heavy storms. I notice in the daily paper that the government barometer at the Springfield armory seems to agree fairly well with mine in its reading, but in that case, it would seem to me that the lettering, which I have noted, is very misleading. I had the impression that a low barometer meant stormy, bad weather and a high barometer fair, dry weather. I would be glad to have you give me any suggestions, either through your paper, for which I am a regular subscriber, or by mail, as you may prefer. A. The words Stormy, Rain, Change, Fair, Very Dry, have no meaning whatsoever upon a barometer, and it is very strange that they should be still placed there, since every maker of instruments knows that they are without meaning. The figures around the circles are inches of mercury. In good weather at the sea level the barometer will be found to indicate about 30 inches. A falling barometer indicates the approach of a storm, a rising barometer indicates the approach of continuance of good weather. A steady barometer indicates the continuance of the present state of the weather, good or bad. A rapid rise or fall indicates high winds. If you live about 900 feet above sea level, the barometer will be one inch lower than it is at the same time at sea level, and at 1,650 feet above sea level the barometer will be two inches lower than at sea level at the same time. If your barometer does not agree quite closely with the government instrument in the same neighborhood, it is probably out of order and should be tested. The high school in your city doubtless has a good barometer, and the teacher of physics there will be very willing to give you his assistance and advice in the matter. A barometer may be expected to change two inches or thereabout in extremes of weather. The best test for a barometer is to hang it by the side of a reliable barometer and compare the reading of the two for some weeks.

(12547) R. N. M. says: Would you please give me a rule or formula for finding the capacity of a cylindrical tank when lying on its side for each inch of the diameter? I desire to make a gage so it can be read at a glance, giving the number of gallons by each inch. The tank is 24 feet long and 93 inches in diameter, with rounded ends, but for our purpose these ends can be considered as square with the diameter. A. There is no simple formula for the volume of the successive "layers" of liquid as the tank is filled. There are tables in the pocketbooks, calculated



from the mathematical formulas, which give the area of segments in terms of the area of the circle. The volume of your tank, 93 inches diameter, 288 inches long, is

$$\frac{93 \times 93 \times 0.7854 \times 288}{231} = 8{,}470 \text{ gallons.}$$

Now, to find the depth to which 100 gallons will fill the tank, we must find the height

of a segment $\frac{100}{8470}$ of the area of the whole 93-inch circle, or 0.0118 × area of circle. From a table of circular areas and segments (see Kent's "Mechanical Engineer's Pocketbook") we find that a segment having an area of 0.0118 times the area of the circle, would in a circle of 1-inch radius, or 3.14 inches area, have an area of 0.0118 × 3.14, or 0.037 inch, and a height of 0.073 inch. In a 93-inch circle the height of the segment would be 0.073 × 93, or 6.78 inches; so that filling your tank to 6.78 inches depth will measure 100 gallons. Similarly, you can calculate (with the aid of the table) the heights for 150, 200, and all other numbers of gallons, and make your scale accordingly.

LEGAL NOTICES

OVER 65 YEARS' EXPERIENCE

PATENTS

TRADE MARKS
DESIGNS
COPYRIGHTS &c.

INVENTORS are invited to communicate with **Munn & Co., 361 Broadway, New York,** or **625 F Street, Washington, D. C.,** in regard to securing valid patent protection for their **Inventions, Trade-Marks** and **Copyrights** registered. **Design Patents** and **Foreign Patents** secured

A Free Opinion as to the probable patentability of an invention will be readily given to any inventor furnishing us with a model or sketch and a brief description of the device in question. All communications are strictly confidential. Our **Hand-Book** on Patents will be sent free on request.

Ours is the **Oldest** agency for securing patents; it was established over sixty-five years ago.

MUNN & CO., 361 Broadway, New York

Branch Office, 625 F St., Washington, D. C.

PATENTS SECURED OR FEE RETURNED

Free report as to Patentability. Illustrated Guide Book, and What To Invent with List of Inventions Wanted and Prizes offered for inventions sent free. VICTOR J. EVANS & CO., Washington, D.C.

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 12 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance.

BUSINESS OPPORTUNITIES

YOUR FACTORY AT TULSA will command the Middle West. Natural gas power only $2 to $5 H. P. per year. 26,000 population. Ample labor, materials. Great oil and coal fields. On large river. Four trunk railways. Sixty three thriving factories already. For further particulars write Industry, Bureau of Information, Tulsa, Oklahoma.

GOOD BUSINESS OPPORTUNITY.—For sale, a well established business, manufacturing and selling a specialty rapidly coming into general use. A nice, clean, interesting business which can be expanded indefinitely. No special manufacturing experience necessary, since present trained and reliable help can be retained. This is an exceptional opportunity for any young man who can command $15,000. Address "Pennsylvania," Box 773 New York.

PATENTS FOR SALE

FOR SALE—A patent on a new kind of plough. A wood beater. Patent issued September 5, 1911. For full particulars, write Frank Koch, patentee. Arndt's Hotel, Saginaw, Michigan.

HELP WANTED.

WANTED—A man or woman to act as our information reporter. All or spare time. No experience necessary. $50 to $300 per month. Nothing to sell. Send stamp for particulars. Sales Association, 683 Association Bldg. Indianapolis, Indiana.

LOCAL REPRESENTATIVE WANTED.—Splendid income assured right man to act as our representative after learning our business thoroughly by mail. Former experience unnecessary. All we require is honesty, ability, ambition and willingness to learn a lucrative business. No soliciting or traveling. This is an exceptional opportunity for a man in your section to get into a big paying business without capital and become independent for life. Write at once for full particulars. Address E. R. Marden, Pres., The National Co-Operative Real Estate Company, L 378 Marden Building, Washington, D. C.

WANTED.

WANTED—One first-class marine engine and boiler draftsman, $5.04 per diem. A competitive examination will be held for the above position October 18. For further information address, Commandant, Navy Yard, Charleston S. C.

WANTED, $25 000 capital with which to purchase several monoplanes of a well-known French make and start an aeroplane factory. Have valuable patent covering this type of machine. Also manufacturing rights of a successful type of aeroplane motor. J. S. 125 East 23rd Street, New York.

MISCELLANEOUS.

INVENTORS.—We want an article of merit on royalty. Must be cheaply manufactured, household utility or novelty preferred. Address, with terms and particulars, Hercules Co., 311 Spring St., Pittston, Pa.

MOTORCYCLES CHEAP.—Send to-day for free catalog of new and used motorcycles. Also motorcycle accessories and attachable motor outfits for converting bicycles into motorcycles. Shaw Manufacturing Company, Dept. 24, Galesburg, Kans.

GINSENG Raising is the surest way to make Big Money on Little Capital. One acre will yield 5000 lbs. Sells at $6 a lb. I will buy all you raise. Grows anywhere. It requires your spare time only. If you are not satisfied with your present income, write me today. T. H. Sutton, 780 Sherwood Ave., Louisville, Ky.

MAKE BIG MONEY operating a Daydark Post Card Machine. Photo postal cards made and delivered on the spot in ten minutes in the open street. No dark room necessary—it does not require an experienced photographer to make first-class pictures. Pays a gross profit of 500 per cent. Write today for free sample and catalogue. Daydark Specialty Co., Dept. 2 V, St. Louis.

FREE—"INVESTING FOR PROFIT" Magazine. Send me your name and I will mail you this magazine absolutely free. Before you invest a dollar anywhere—get this magazine—it is worth $10 a copy to any man who intends to invest $5 or more per month. Tells you how $1,000 can grow to $22,000—how to judge different classes of investments; the Real Earning Power of your money. This magazine six months free if you write to-day. H. L. Barber, Publisher, 42S, 28 W. Jackson Blvd., Chicago.

INQUIRY COLUMN

Inquiry No. 9255. Wanted, to buy a patent roller, a ball-bearing axle, which could be purchased on a royalty basis; it must be clean and fully proved.

Inquiry No. 9256. Wanted addresses of parties having Pitchblende deposits, if able to ship ore.

Inquiry No. 9257. Wanted addresses of firms selling second-hand water turbines.

Inquiry No. 9258.—Wanted addresses of parties having gem materials to offer in any part of the world.

Inquiry No. 9259.—Wanted to buy a machine for removing the coating of a filbert.

Inquiry No. 9260.—Want addresses of parties able to ship corundum, garnet, flint, emery or any material suitable as an abrasive.

The Current Supplement

TRUE economy is based, not on a mere policy of doing things cheaply, but on a systematic and scientific plan of controlling value received against price paid. How the Pennsylvania Railroad guards against loss by poor materials is told us in a valuable article in the current issue of the SUPPLEMENT.—Prof. Turner's article on The Great Star Map reaches its sixth instalment. Balloonists have observed that to them the surface of the earth appears bowl-shaped. The cause of this is explained by Dr. Charles Forbes of Columbia University.—The sewage purification industry is far from having become standardized. A new apparatus which has been found to give much satisfaction is described by our Berlin correspondent.—In a very excellent article Mr. A. J. Jarman gives practical instructions for the amateur, which will enable him to prepare and mount photographs upon watch lids and the like.—The farmer will find in this number useful information regarding the construction of concrete silos. In these days of remarkable technical development and substitution of all sorts of artificial products for the natural, it is refreshing to note occasionally that for some particular purpose some simple product of nature is still found indispensable. The use of spiders' threads in optical instruments is discussed by W. F. Rigge, who tells us how, on a certain occasion, an entire department of Creighton University Observatory was put out of commission for want of a spider's thread.—Many are the attempts made by amateurs to solve certain mathematical problems, such as the trisection of the angle. It is unfortunate that much ingenuity should be wasted upon such efforts, and discussion of this topic by N. P. Dupuis, should prove very beneficial in clearing up an unfortunate misunderstanding. The problems as ordinarily stated are incapable of solution, not because of any intrinsic bar to such solution, but because of the artificial restrictions imposed by the injunction that the problem shall be solved entirely by Euclidian methods. Remove this restriction and the problems can be solved without difficulty. Insist on this restriction and it can be proved that the problem is incapable of solution.—The influence of the mercury vapor lamp upon the eye is discussed in a note by Dr. W. H. Williams.—We think of surgery as a destructive measure, which may remedy an ill by removing a part of the body which nature intended to be retained. Some of the newest developments bear the promise of constructive work, in which a deficient organ is replaced by a healthy one derived from some external organism. This subject is discussed in an article derived from *La Nature*.—Some interesting new light has recently been shed upon the process of fertilization by researches on the influence of radium upon the frog embryo. A short account of this work is given in the current issue.—From the fertile mind of Svante Arrhenius we have an article on the Fate of the Planets.

The Disposition of Guns in the Dreadnoughts

(Concluded from page 318.)

The second turret from forward is superposed, as is also the second from the stern, the object in each case being to increase the volume of fire along the line of the keel. The fourth turret from aft is also superposed above the third, but here the saving of length was the object in view, as these guns do not bear aft. (Fig. 12.)

The only other six-turret "Dreadnoughts" with a 100 per cent broadside are the Argentine ships "Moreno" and "Rivadavia." These vessels, with twelve 12-inch guns, have four turrets on the middle line and two echeloned (Fig. 13). There has been, and probably will continue to be, much controversy as to which is the more effective arrangement; but the fact remains that the "Wyomings" can cover an arc of 95 degrees on either beam with all twelve guns, while in the case of the Argentine ships this is 10 degrees less. For ten guns the respective figures are 120 degrees and 105 degrees, and for eight, 135 degrees and 120 degrees. The Brazilian battleships "Sao Paolo" and "Minas Geraes" have their guns arranged on a similar plan to the Argentine vessels, but the superstructure divides the echeloned turrets, which are therefore not available on both broadsides.

For practical purposes the French battleships "Jean Bart," "Courbet," "France," and "Paris" are similar to the Brazilian, two turrets being mounted forward and aft (with one superposed in each case), and two abreast amidships. (Fig. 13.)

We now come to a striking variation in design. The German battleships "Rheinland," "Posen," "Nassau," and "Westfalen" all have twelve 11-inch guns as their main armament; but they are so disposed in their six turrets that only eight guns bear on the beam. (See Fig. 15.) It was at first thought that this system was due to a misapprehension as to the system of naval tactics which the "Dreadnought" principle involved, but this is hardly borne out by the fact that the arrangement is being strictly adhered to. The "Thuringen," "Helgoland," "Ostfriesland," and "Oldenburg" are armed with twelve 12.2-inch guns apiece; but the distribution remains the same. Although, therefore, these ships carry as many big guns as the "Wyoming," the latter is 50 per cent superior on the broadsides. The German vessels, with their twelve guns, are no better as line-ahead broadside fighters than the "Michigan," the British "Invincibles," or even the 15,500-ton Spanish Espanas—leaving questions of speed and protection out of consideration.

Curiously enough, the Japanese have also adopted this system, at least for their first two all-big-gun ships, the "Kawachi" and "Settsu," for the distribution of the 12-inch guns in these ships is the same as that of the 11-inch and 12.2-inch in the German vessels. The average student of the naval war between Japan and Russia will be hard put to it to find any justification for this subordination of the broadside; and it is more difficult to understand since it has been reliably stated that all the data gleaned by the Japanese were placed at the disposal of the British authorities. The same tactical data could hardly justify the "Orion" (Fig. 7) and at the same time excuse the "Kawachi" (Fig. 15.)

Summarizing these details, it will be found that the total number of heavy guns mounted in the 69 ships of the "Dreadnought" era whose details are known is 723, a total that could not have been attained with fewer than 181 ships of the pre-"Dreadnought" era. The ownership of the guns, as well as certain other details, is shown in the following table:

Countries.	Number of Ships.	Details Known of.	Guns Mounted (Inches Caliber). 14-Inch. Total.	14-Inch. Broadside.	13.5-In. Total.	13.5-In. Broadside.	12-Inch. Total.	12-Inch. Broadside.	11-Inch Total.	11-Inch Broadside.
Great Britain.	32	27	...	...	104	104	252	238	.	...
United States	12	10	20	20			100	100	...	...
Germany	21	9	...	...		....	48	32	56	40
Italy	4	4	...	...	....	....	51	51		...
Russia	4	4	...				48	48		...
France	4	4	...	...			40	49		...
Spain	3	3	...				24	24		...
Argentine	2	2	...			....	24	24		...
Brazil	3	2	...				24	20		...
Japan	7	2	...				24	16		...
Austria	4	2	...				24	24		...
Turkey	2	0	...	...		..				...
Chili	2	0	...	...						...
Totals	100	69	20		104		543		56	
Number of guns in three-gun turrets.			....		..		111		...	
Number of guns in center-line turrets.			20		104		407		20	

It will be noted that as the caliber increases so does the desire to place all the guns on the middle line.

A Political Laboratory

A POLITICAL laboratory has been established at Columbia University through the generosity of Patrick F. McGowan, ex-president of the board of aldermen, and will be available at once for the 150 students of politics at the university. Sufficient money has been given by Mr. McGowan to maintain the labora-

There is an air of *substance* that distinguishes wearers of

von Gal made Hats

"CORRECT STYLES FOR MEN"

Absolutely correct styles, splendid workmanship, fine materials and trimmings unite to give these hats a tone that is instantly recognized. Wear guaranteed.

Prices, $3, $4 and $5. At your dealer's, or if he cannot supply you, write for Fall and Winter Style Book A, and we will fill your order direct from factory if you indicate style wanted and give hat size, your height, weight, and waist measure. Add 25 cents to cover expressage.

We are Makers of the Hawes Celebrated $3 Hat

Factories: Danbury, Conn. Niagara Falls, Ontario, Canada. Straw Hat Factory: Baltimore, Md.

Hawes, von Gal INCORPORATED

Offices and Salesrooms: 1178 Broadway New York. 207 Washington Street Boston.

Can You Shave?
Rub a little "3in One" on your razor strop till leather becomes soft and pliable; draw razor blade between thumb and finger moistened with "3in One"; then strop. The razor cuts 5 times as easy and clean; holds the edge longer. "A Razor Saver for Every Shaver" which gives the scientific reasons, and a generous trial bottle *sent free*. Write to-day.
3 IN 1 OIL CO.,
42 A Z R Broadway New York.

ELLIS ENGINE USE KEROSENE
gasoline, distillate—any fuel oil. Cheapest, Safest, Simplest POWER for Electric Lighting, Water Systems, Vacuum Cleaners everything. Complete plans furnished, expert advice. Adapted for basements—anywhere. Women can operate. Comes complete. Ten exclusive revolutionizing features.
We Pay the Freight
FREE TRIAL
No obligation till satisfied. 10-year guarantee. "Engine Facts" free; write for it NOW.
ELLIS ENGINE CO.
52 Mullett St. Detroit, Mich.
3-12

A LAMP LIKE THIS IN EVERY ROOM
$10.26 AND UP FOR COMPLETE APPARATUS
would modernize your home at little cost. A hundred other styles to select from, including Table Lamps and Chandeliers.
Each Lamp given 400 candle-power at one-half cent an hour.
American Lighting Systems are guaranteed to pay for themselves within a few months, and to give complete satisfaction.
Seventeen years in the business means that we are reliable. Write for new catalogue, just issued—it's FREE.
Agents wanted. Good territory still open.
AMERICAN GAS MACHINE CO.,
143 Clark St., Albert Lea, Minn.
Fargo, N. D. Binghamton, N. Y.

BARKER MOTORS
Reliable.—1¼ to 10 H. P.—Economical
Their perfect operation and reliability are due to common sense mechanical ideas and good construction. While low in price, they are made of best materials with careful attention to details.
C. L. BARKER, NORWALK, CONN.

Nulite Gasoline Table Lamp
A beautiful lamp for homes, hotels, offices, stores, banks, cafes. Portable, safe; can be turned upside down or rolled on the floor without danger of affecting the light. 300 C. P. of soft, brilliant light, one-third cent per hour. Also 500 different styles of lamps and systems.
AGENTS—We want town, county, and traveling salesmen. Best proposition ever offered. Sells everywhere. Write for Special Offer.
National Stamping & Electric Works
412 So. Clinton St. CHICAGO

GOES LIKE SIXTY SELLS LIKE SIXTY SELLS FOR SIXTY **$60**
GILSON GASOLENE ENGINE
For Pumping, Cream Separators, Churns, Wash Machines, etc. FREE TRIAL
Ask for catalog—all sizes
GILSON MFG. CO. 808 Park St. Port Washington, Wis.

AIR GAS! Latest Invention
Standard Vacuum Gas Machine makes gas automatically! Uses 97% ordinary air! Cheapest, safest, most hygienic for lighting, heating and cooking! All conveniences of city gas! Non-poisonous, non-asphyxiating, inexplosive and inodorous! Machine always ready! Gas can be made for 15c per 1000 cu. ft. 125 times cheaper than acetylene! Cheaper than kerosene lamps, electricity or city gas! Saving will pay for the machine in a few months! Agents wanted everywhere in the United States and abroad! Machine of 25 light capacity, $125.00.
Standard-Gillette Light Co., 10 H Michigan St., Chicago, U. S. A.

JAGER Marine 4-Cycle Engines
Skillfully designed and well built. Single lever control, combining automatic carburetor with spark advance. Develops wide speed range and reliability under most trying conditions. Sizes 3 to 60 h. p. Send for catalog.
CHAS. J. JAGER CO.
281 Franklin, cor. Batterymarch St. Boston, Mass.

AIRCRAFT—The World's Great Flying Magazine
contains a complete review of everything taking place throughout the entire world in aeronautics
IT contains the most beautiful illustrations from every quarter of the globe. It gives complete Records and Statistics of the movement from its inception. Its construction work is accurate beyond question. It describes minutely the newest types of flyers. It contains articles written by the most famous men connected with the Science of aerial flight. At the present time all progressive men are studying this great new art of flying. ¶ **AIRCRAFT** is generally recognized by the leading authorities on the subject as being the organ of the movement itself. ¶ IT IS PUBLISHED MONTHLY
Its subscription price is $1.50 per year, or $1.00 for eight months
THE LAWSON PUBLISHING CO., 37-39 East 28th St., New York, N. Y.

About Remembering

By ELBERT HUBBARD

HENRY DICKSON

America's Foremost Authority on Memory Training and Principal Dickson School of Memory, Auditorium Building, Chicago.

FOR a long time I have been promising myself to write up my good friend, Mr. Henry Dickson, of Chicago, and I have not forgotten.

Mr. Dickson is teaching a Science or System, which I believe is of more importance than the entire curriculum of your modern college.

MR. DICKSON teaches memory.

Good memory is necessary to all achievement.

I know a man who is a graduate of three colleges. This man is neither bright, interesting nor learned. He's a dunce.

And the reason is that he CAN NOT REMEMBER. He can not memorize a date or a line of poetry. His mind is a sieve.

Education is only what you remember.

Every little while I meet a man who has a memory, a TRAINED MEMORY, and he is a joy to my soul.

The manager of a great corporation never misses a face. If he sees you once the next time he will call you by name. He told me how he did it. He studied memory training with Prof. Dickson. He said a lot of nice things about Prof. Dickson, that I hesitate to write here lest my good friend Dickson object.

This Dickson system of memory-training is very simple. If you want to enlarge your arm, you exercise it. The same with your mind. You must put your brain through a few easy exercises to discover its capacity. You will be surprised how quickly it responds.

You do not know when you will be called upon to tell what you know; and then a trained memory would help you.

To the man or woman whose memory plays tricks I recommend that you write to Prof. Dickson, and if his facts do not convince you, you are not to be convinced.

Write today for FREE booklet and facts. Address,

PROF. HENRY DICKSON

700 AUDITORIUM BUILDING CHICAGO

RISK 25c

It will be the best investment in smoking tobacco you ever made.

Royal Flush Mixture

It's the tobacco you have been looking for. Carefully blended—Pure, delicious and cool.

Extraordinary If your dealer will not supply you, send his name and 25c for large can. Send today and ask for FREE booklet: *"How to Smoke a Pipe."* 1¾ oz. 25c; 3½ oz. 50c; ½ lb. $1; 1 lb. $2 prepaid.

E. HOFFMAN COMPANY, *Manufacturers*
175 Madison Street, CHICAGO

HELMET OIL **LUBRICATES ANYTHING** SEND FOR SAMPLE FREE
118-124 North Clinton St. CHICAGO, U.S.A.
CHESLYN & CO.

WIN THIS $1200.00!

Thousands Already Won—Going on Daily

TEN PEOPLE GET $40,000

They Tell You How to Win.

LISTEN! Stoneman(Nebr. photog'ph'r) actually received **$1200 one month**, $31.80 in 15 minutes, **$800 in 11 days**; Korstad (Minn. solicitor) **$6918 in 2 weeks**; Sevegne (N. Y. telegrapher) **$100 daily.** Not a fairy tale, fake or humbug, but **proven** absolutely true by **sworn statements. Government patronage**, statesmen, judges, bankers, world's famed institutions, local references. **Costs nothing to investigate.** This gigantic money-making contest no longer controlled by a few—now open to **any** honest, industrious **man or woman. Big money made** by **mechanics, clerks, farmers**, teachers, doctors, lawyers, people from all walks of life. **Experience, capital, business training unnecessary. You can** own, operate and control same private enterprise that brought Wilson(banker) **$5,000 in 30 days**; Rasp(agent) **$1685 in 73 days**; Oviatt (minister) **$4,000**, Rogers (surveyor) **$2800**; Juell (clerk) **$6800**; Hoard (doctor) **$2200**; Hart (farmer) **$5,000.** Schleicher (minister) **$193 first 12 hours. Hundreds** clearing similar prosperity — banking money, buying homes, automobiles. Don't wonder. **Same appointment** should mean **same money for you** — same power, prominence, dignity, respect, influence. Rise to big earnings, wage freedom, ownership and private monopoly. **Knowing the reason dispels all doubt.** Wonderful, but true. **Strange Invention gives every home a bath room for only $6.50**; excels others costing $20. Abolishes tubs, bowls, buckets, wash rags, sponges. Turns any room into a bath room with **hot or cold running water.** Think of it! So energizes water, one gallon amule; cleanses almost automatically; **no plumbing; no water-works; self-heating.** Gives cleansing, friction, massage and shower baths. So simple child can operate. **Truly marvelous.** A modern home-bathing without drudgery, inconvenience, muss of lugging water, filling tubs, emptying, cleaning, putting away. Could anything be more popular? Think of **millions** who want bathrooms! At sight people exclaim: "There, there, that's what I've been longing for." Little wonder Wilson **sold 102 in 14 days**; Hart, **16 in 3 hours.** Think what you could do. Come—fall in line—**make a fortune.** Don't let another get there first. **Your chance** now to secure **exclusive sale.** Devote all or spare time. Means phenomenal earnings; no competition; fascinating, high-grade business. Credit given active distributors. Send no money—investigate first. Send to-day for remarkable offer—it's valuable but free. Address

M. Stoneman

M. Juell

"SEE IT ENERGIZE"

ALLEN MFG. CO., 3391 Allen Building, TOLEDO, OHIO

A New Opportunity in Industrial Education

THE first requisite of education should be that it helps the boy to make a livelihood. Whatever else it may do it should at least train him properly for some occupation. Education which thus ministers to self-support is attracting wide attention, and the need for the development of trade schools in all important industrial centers has become everywhere recognized.

In this matter of trade schools, Boston merits particular attention as it is especially in advance in this direction. The most recent accession to the list of existing educational institutions is the New Wentworth Institute. This most important addition to the present educational facilities of the Commonwealth, which are so amply provided and so excellent in many other directions, furnishes new and very much needed opportunities in the industrial field where at present there are none.

The new Trade School was founded by the late Arioch Wentworth, a citizen of Boston, who left over three and a half million dollars for the purpose of "Furnishing Education in Mechanical Art."

The aim of the new school is to give young men practical instruction which will enable them to enter industrial life prepared to do and earn from the moment of graduation. These courses are for those who wish to become skilled and intelligent artisans and industrial workers, and also for those who wish to prepare themselves for more responsible positions in mechanical and manufacturing plants.

"To furnish education in mechanical arts" is the statement of purpose made by Mr. Wentworth in his bequest. This phrase defines both the general field of education which the new school occupies, and it also defines with equal definiteness many of its essential characteristics. It is a school to furnish education in mechanical arts; in other words, a school to train young men for a higher degree of efficiency in mechanical trades requiring both skill and intelligence than they may attain through any opportunities which are now open to them.

The End of the British Naval Airship

THE first naval airship built for the British government by Vickers, Sons & Maxim, at a cost said to be $400,000, was wrecked in Barrow in Furness on September 24th. It seems to have been ruined from the same cause that brought about the destruction of so many Zeppelin craft, namely, the impossibility of preventing the airship from being battered against its own shed when half drawn out.

The new dirigible, which has been fully described in these columns, never really flew. It was taken out on May 22nd, but failed to ascend. The builders thereupon undertook to lighten it, and the Admiralty finally accepted it on September 22nd.

Electricity

Queen Mary's Fan.—An electric fan has recently been made by the General Electric Company for Queen Mary of England. It has been designed to harmonize with the royal toilet articles. It is mounted in gold, and is provided with an ebony switch. The fan will be used to dry the Queen's hair, after a shampoo.

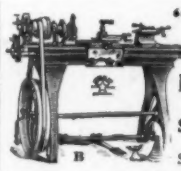
Electric Lamps Here and Abroad.—There are in Boston, says the *Electrical Review and Western Electrician*, the equivalent of 1,232 sixteen-candle power electric lamps per thousand of population, in New York 859, in Chicago 730, and in San Francisco 660. European cities show much smaller figures, St. Petersburg having 440, Vienna 246, Paris 185, and London only 4.

Electrocuting the Codling Moth.—The owner of an apple orchard in Spokane has constructed an apparatus with which he hopes to rid his orchard of the codling moth. He uses electric incandescent lamps, surrounded by a metal netting, which is charged with electricity. The moths attracted by the light strike the wire and are instantly killed. The cost of the storage battery and lamps is comparatively small.

Electricity from Peat in Canada.—The Canadian government, wishing to arouse interest in the utilization of peat, has built a plant at Ottawa and secured a peat bog of three hundred acres near Alfred, Ontario. The plant is equipped to make producer gas from the peat, which will be used in a 60-horse-power four-cycle gas engine, directly connected to a 50-kilowatt dynamo. It is estimated that there are 36,000 square miles of peat in Canada, which would yield 28,000,000,000 tons of air-dried peat, which would be equivalent to 14,000,000,000 tons of coal. To demonstrate the commercial practicability of utilizing peat for power purposes a building adjoining the Ottawa plant will be fitted up as an ore-dressing laboratory and will be operated by the electricity generated from the peat.

Wireless Telegraphy in the Congo.—A recent consular report states that within five years there will probably be 200 wireless telegraph stations in operation in the Congo. A Telefunken station is in operation at Boma, the capital of Belgian Congo, and a station of the French Ferrier type at Banana, the principal seaport. Each of these is of 1½ kilowatts, but the latter will shortly be increased to 5 kilowatts. The Telefunken engineers expected to erect in September a 5-kilowatt station at St. Paul de Loanda, in the adjoining Portuguese territory at Angola, after which a station was to be established at Leopoldville, on the Congo River. If these stations prove successful, an extensive series of stations will be erected all along the Congo and Kasai rivers. The French company expects in the near future to erect a station at Loango, French Congo, and later stations in all the French West African colonies.

Electrical Fires in Chicago.—Some interesting facts gathered from the annual report of the city electrician of Chicago are quoted by the *Electrical World*. These relate to the electrical inspectors' reports on electrical fires in that city during the year 1910. A table is given to show that there were eighty such fires, with a total loss of $37,550, a small amount compared with the total fire loss. Of this amount, one fire caused a loss of $30,000, the cause in this case being the breaking of a lighted portable incandescent lamp, the sparks from which fell into gasoline and oil on the floor. The next largest loss was caused by a fire due to sparks from a defective socket falling on chemicals. This defective socket was suspended over the chemicals by lamp cord extended through a metal hood. The loss was estimated by the inspector at $5,000. In all other cases the loss was comparatively slight. Of the eighty electrical fires, fifteen were due to low-tension wires short-circuited, nine to motor burn-outs, seven to sparks from motors, five to overheated flatirons, five to wires grounded in conduits, four to low-tension wires grounded, four to defective rheostats, four to lightning, four to short-circuits at fixture outlets, four to breaking of incandescent lamps and the rest to a variety of causes.



"STAR" Foot and Power Screw Cutting Automatic Cross Feed **LATHES**
For Fine, Accurate Work
Send for Catalogue B
SENECA FALLS MFG. CO.
695 Water Street
Seneca Falls, N. Y., U. S. A.

SEBASTIAN LATHES
9 to 15 Inch Swing
High Quality Low Prices Catalog Free
THE SEBASTIAN LATHE CO., 120 Culvert St., Cincinnati, O.

The "BARNES" Positive Feed

Upright Drills
10 to 50-inch Swing
Send for Drill Catalogue
W. F. & Jno. Barnes Co.
(Established 1872)
1999 Ruby Street Rockford, Illinois

THE MOST USEFUL PLYER MADE

Starrett Patent Expansion Plyers. Drop forged steel; hand as struck up from heavy stock give unusual strength. Jaws take to 1¾ in. Grips round or tapered objects. Effective pipe wrench. Hold or turn nut or bolt. Strongest grip known. Plain $2.00; nickel $2.25.
Send for 274 page catalog, No. 19-B.
THE L. S. STARRETT CO., Athol, Mass., U. S. A.

THE BEST EQUIPPED SHOP
For Mechanical and Electrical Manufacturing
Special Machinery, Jigs, Tools, Repairs, Experimental Devices
Designing and Commercializing a Specialty
THE UNIVERSAL TELEGRAPHIC COMPANY
Successors to The Rowland Telegraphic Co. BALTIMORE, MD.

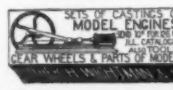
Manufacturing of Special Machinery, Metal Specialties, patented Devices, Dies and Tools, Stampings, Screw Machine Work.
Model and Experimental Work.
M. P. SCHELL MFG. CO.
509-511 Howard St. - - - - San Francisco, Cal.

WANTED To manufacture METAL SPECIALTIES, 20 years experience in making Dies, Tools and Special Machinery. Expert work. Complete equipment. NATIONAL STAMPING & ELECTRIC WORKS Dept. 2, 412 So. Clinton Street, - Chicago, Ill

Patented Articles and Metal Specialties
MANUFACTURED BY CONTRACT
Stamping Dies, Metal Stampings and Screw Machine Work
H. CARSTENS MFG. CO., 567 W. Lake St. CHICAGO

NOVELTIES & PATENTED ARTICLES
MANUFACTURED BY CONTRACT. PUNCHING DIES, SPECIAL MACHINERY.
E. KONIGSLOW STAMPING & TOOL WORKS, CLEVELAND, O.

Models & Experimental Work
INVENTIONS DEVELOPED
SPECIAL MACHINERY . . .
E. V. BAILLARD CO., 24 Frankfort St., N.Y.



MECHANICAL SUPPLIES and MATERIAL of all kinds
EXPERIMENTAL AND LIGHT MACHINE WORK to order.
102 MILK STREET BOSTON

Manufacturers of Metal Specialties, Stampings, Dies and Tools. Thirty Power Presses at your service.
Hoeft & Company, Inc. CHICAGO, U. S. A.
141-143-145 West Michigan Street, corner La Salle Avenue

ICE MACHINES Corliss Engines, Brewers and Bottlers' Machinery
The VILTER MFG. CO.
899 Clinton Street, Milwaukee, Wis.

DURYEA BUGGYAUT
You may **experiment** with many, but for simplicity and durability you will use a Buggyaut.
"ITS THE ULTIMATE THING."
C. S. DURYEA AUTO CO., SAGINAW, MICH.

Incorporate Your PATENTS and BUSINESS in ARIZONA
Laws the most liberal. Expense the least. Hold meetings, transact business anywhere. Blanks, By-Laws and forms for making stock full-paid for cash, property or services, free. President Stoddard, FORMER SECRETARY OF ARIZONA, resident agent for many thousand companies. Reference: Any bank in Arizona.
STODDARD INCORPORATING COMPANY, Box 8000
PHOENIX, ARIZONA

BIG MONEY FOR YOU
Selling our metallic letters for office windows, store fronts, and glass signs. Any one can put them on. Nice, pleasant business. Big demand everywhere. Write today for free sample and full particulars.
METALLIC SIGN LETTER CO., 438 North Clark Street, Chicago

BAKELITE

(REG. U. S. PAT. OFF.)

the new synthetic substance of many applications.
Write for booklet.
GENERAL BAKELITE COMPANY, 100 William St., New York, N. Y.

"Red Devil" No. 024

Far Famed as a GLASS CUTTER

Millions have been sold

It will cleanly cut a maximum number of feet of glass with a minimum effort—and the tool will prove it. "It's all in the wheel." At all dealers. 10c.

It's one of the "Red Devil" Tool Family.

Smith & Hemenway Co.
150 Chambers Street New York City

DON'T PAY TWO PRICES
Save $18.00 to $22.00 on
HOOSIER HEATERS & RANCES

Why not buy the best when you can buy them at such low, unheard-of Factory Prices? THIRTY DAYS FREE TRIAL BEFORE YOU BUY. Our new improvements absolutely surpass anything ever produced. SEND POSTAL TODAY FOR OUR FREE CATALOG AND PRICES
Hoosier Stove Factory
257 State St., Marion, Ind.

WELL DRILLING MACHINES

Over 20 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on sills. With engines or horse powers, strong, simple and durable. Any mechanic can operate them easily. Send for catalog.
WILLIAMS BROS., Ithaca, N. Y.

A Home-Made 100-Mile Wireless Telegraph Outfit ¶ Read Scientific American Supplement 1605 for a thorough clear description, by A. Fred'k Collins. Numerous adequate diagrams accompany the text. Price 10 cents by mail. Order from your newsdealer or from
MUNN & CO., *Inc.* 361 Broadway, New York

The *Loxograph* Enormous saving of time in making tracings from mechanical drawings. Circular free.
THE LOXOGRAPH INSTRUMENT CO., Wilmington, Delaware

Solders and Soldering

¶ If you want a complete text book on **Solders** and the art of **Soldering,** giving *practical, working* recipes and formulæ which can be used by metallurgist, the goldsmith, the silversmith, the jeweler, and the metal-worker in general, read the following *Scientific American Supplements:* 1112, 1384, 1481, 1610, 1622, 1434, 1533, price 70 cents by mail. ¶ Order from your newsdealer or from
MUNN & COMPANY, *Inc.*
Publishers, 361 Broadway, New York

LEARN A TRADE
BE YOUR OWN BOSS
Steady, big paying work if you learn **Electrical Work, Plumbing, Bricklaying, Painting** and **Decorating,** by our practical, personal instruction. Actual work takes place of books. We help graduates to good positions. Easy payments. Low living expenses. **Tools and materials furnished free.** Write to-day for free catalogue
COYNE NATIONAL TRADE SCHOOLS
60 E. Illinois Street Chicago, Ill.

Wizard Repeating LIQUID PISTOL

Nickle-plate 3 in. long. Pat'd

Will stop the most vicious dog (or man) without permanent injury. Perfectly safe to carry without danger of leakage. Fires and recharges by pulling the trigger. Loads from any Liquid. No cartridges required. Over six shots in one loading. All dealers, or by mail, 50c. Rubber-covered Holster, 10c. With Pistol, 55c. Money-order or U. S. stamps. No coins.
PARKER, STEARNS & CO., 298 Sheffield Avenue, Brooklyn, N. Y.

SEE THE WORLD AND EARN BIG PAY AS A CIVIL ENGINEER

If you want to go somewhere—do something—be somebody—here's the chance. Our complete, practical, easy-to-learn HOME STUDY COURSE BY MAIL quickly solves the problem—if you will merely apply yourself during spare moments. We are one of the largest instruction-by-correspondence institutions in the world—enrolling thousands of students yearly, in all branches of Engineering and Business. TUITION PAYABLE ONLY OUT OF INCREASED SALARY, after you learn. Write for illustrated booklet: "GETTING A LINE ON THE CIVIL ENGINEER." It will tell you how.
AMERICAN SCHOOL OF CORRESPONDENCE
Dept. 320 Chicago, Ill.

Engineering

A Sewer System for Tokyo.—A consular report from Japan states that the city of Tokyo will install a complete system of modern sanitary sewerage before the opening of the world's exposition, which is to commemorate the fiftieth anniversary of the crowning of the Mikado. Tokyo has a very large area in proportion to its population, viz., about 100 square miles; hence the installation of sewers will be an immense undertaking. The cost is estimated at from $17,000,000 to $20,000,000.

The Dreadnought "New York."—Following the "Connecticut" and the "Florida," the keel of the largest of our battleships, the "New York" has been laid at the New York Navy Yard on the same ways on which the two first-named ships were built, and excellent progress is being made upon the ship's floor. A touch of sentiment was lent to the occasion by the fact that the first bolt was put in place by the young grandson of the late Rear Admiral Sampsón. The "New York" will be 573 feet long, 95 feet, 2 inches broad, will displace 27,000 tons, and will carry ten of the new and very powerful 14-inch rifles.

Heat of Exhaust.—Experiments were recently made by one of the leading Swiss firms as to utilizing the waste heat of exhaust gases from internal combustion motors. In the present case the Sulzer-Diesel motor was used. Water is heated by the exhaust, and the exhaust gases are sent through a set of tubes placed inside a water tank. Air for various purposes can be readily heated, for drying ovens or other purposes. One of the main difficulties was to make the tubes of a suitable material so that the exhaust gases would not attack it. However it was found that certain special kinds of cast iron will serve the purpose very well.

"Spotting" by Camera.—At present the fall of the shots in target practice is observed from the tops of the cage masts of our battleships and cruisers; the "spotter" noting through his glasses whether the shot falls short or over, or has a deflection to right or left. Lieut. Com. Cleland Davis, whose torpedo has been illustrated in this journal, has invented a method of spotting by the aid of the camera. The splash is photographed and in a few seconds the negative is developed. The necessary corrections in the range and deflection are then made, and it is stated that the operations are so speedy that there is practically no delay as compared with the present methods of spotting.

Lubricating Oil Tests.—From the fact that it is a common practice to use lubricating oil again after filtering it, Messrs. Sabatie and Pellet found it of interest to see whether such used and filtered oil showed any great difference from fresh oil. Analyses showed the following results. The density of the oil is somewhat increased, this being no doubt due to the evaporation of volatile portions of the oil. The flash point and combustion are a few degrees higher. About the same viscosity was observed in both cases. The acidity of oils is not changed, but the percentage of vegetable or animal oil in mixed oils is considerably lessened. From a practical standpoint the used and filtered oil keeps all its lubricating qualities, provided that care is taken to secure a good filtering so as to remove all the solid particles.

Double-decking a City Street.—Chief Engineer Goodrich of the Bureau of Encumbrances, of the Department of Highways, New York, has proposed a plan for the double-decking of 42nd Street, New York, between 5th and Lexington Avenues. The street is one of the most congested in the city, there being probably no place in the world where so many systems of transportation center as here. The double-decking of the street will give an opportunity for separating the traffic, to say nothing of at once doubling the capacity of the street. Here is a problem which will have to be met and successfully solved as the modern office building twenty to thirty stories in height gradually replaces the older building. Some of the down town streets of New York are already congested almost to a standstill.

Science

An Anthropological Expedition to New Guinea.—*The Geographical Journal* announces that the Committee for Anthropology at Oxford is about to send an expedition for anthropological research to the little known D'Entrecasteaux group, off the eastern end of New Guinea. It will be under the leadership of Mr. D. Jenness, of Balliol, who won distinction at the University of New Zealand before proceeding to Oxford, and who has had practical experience of life in the bush.

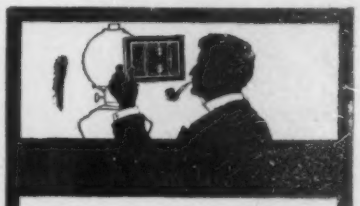
Ostia.—Director Marino Vaglieri of the National Museum at Rome has opened several Republican tombs in the course of his researches at Ostia, once the chief port of Rome at the mouth of the Tiber. A fountain statue of Aphrodite came to light in the Roman theater. It is recalled that the Townley Venus in London was found at Ostia. The new one resembles another statue of equally Praxitelean style which the late Professor Furtwaengler coupled with the London figure, namely, the Venus of Arles.

Horace's Villa.—The exploration of Horace's villa in the valley of the Licenza near Mandela has been resumed by A. Pasqui. Two sites claim the honor of this name and have divided the pilgrims to the Latin poet's home into camps. Both offer scanty remains of Roman country houses. Whether Pasqui will find any relics as old as the reign of Augustus is very doubtful. But his villa ruin will serve a purpose if it only entices more tourists out of the hot streets of Rome to the outdoor charm of the Sabine Hills.

Distribution of the Elements in the Earth's Crust.—The solid crust of the earth, with a specific gravity of only about 2.5, as against 5.7 for the entire globe (crust and liquid or semi-liquid interior) is said by Rosenbusch to consist of the various elements in the following proportions by weight: Oxygen, 47.29 per cent; silicon, 27.21; aluminium, 7.81; iron, 5.46; calcium, 3.77; magnesium, 2.68; sodium, 2.36; potassium, 2.40; hydrogen, 0.21; titanium, 0.33; carbon, 0.22; chlorine, 0.01; phosphorus, 0.10; manganese, 0.08; sulphur, 0.03; barium, 0.03; chromium, 0.01.

To Remove Tattoo Marks.—Once tattooed, always tattooed, was formerly the rule; but a French army surgeon, Dr. Tranchant, has discovered a method of removing tattoo marks, whether made with India ink or lampblack. According to *La Nature,* the process consists of first rubbing the skin until a thin layer of the surface is worn away, then applying a mixture of lime, slaked just before use, and powdered phosphorus. The tattooed part having been coated with this paste, a piece of gauze is laid over it, covered with a bandage. The dressing is removed after forty-eight hours. The scab is allowed to dry in the air, and comes away in about a fortnight, without leaving a scar. If any trace of the tattooing then remains, the treatment is repeated. Dr. Tranchant claims to have applied this treatment in a great many cases, with perfect success.

A Cold Winter in the Levant.—According to a report from the American consul at Aleppo, last winter in that vicinity was one of almost unprecedented severity. The snow was from two to four feet deep on the level, and covered the plains of the entire country around Aleppo, as far south as Bagdad, and north and east to Diarbekir and Mosoul, while the mountainous districts and the railway from Aleppo to Beirut were entirely blocked for a period of about two months, not even the mails arriving for some four weeks. If, as we infer from this statement, snow fell in Beirut, it was the first since meteorological observations were begun there upward of thirty-five years ago. It is stated that drivers and travelers were frozen to death on the roads, many flocks of sheep perished together with the herders, and numerous families of Bedouins were found frozen in their tents. It is estimated that between 50 and 60 per cent of the sheep were frozen or starved to death, so that there will be a great reduction in the export of skins, wools and stock for meat purposes during the next year or two. The olive orchards were also badly damaged.



Your best negatives deserve and your poorest negatives require

VELOX

The one paper made expressly to give the best results from the average amateur negative.

If you do your own printing use Velox because it is simplest, if you have your work done for you insist on Velox, because it is also best.

Velox offers a wide variety of surfaces and qualities from which to choose. The Velox Book, free at your dealers or by mail, tells all about them and explains in full the methods of handling the paper.

NEPERA DIVISION,
EASTMAN KODAK CO.,
Rochester, N. Y.

The kind of true stories young folks love, and parents approve.

Stories of Useful Inventions
By S. E. FORMAN

Profitable and entertaining stories of the beginnings of everyday things—the match, stove, lamp, plow, etc.—tales which make the most of all the history and humanity wrapped up in these inventions. *A regular picture book of useful inventions, too.*

$1.00 net, postage 11 cents

Published by THE CENTURY CO., New York

INVENTORS We build models, do experimental work, light manufacturing dies and tools.
G. SCHWARZ & CO., 123 Liberty St., N.Y.

Pens that have elasticity—make either a fine or a coarse stroke—and don't stay spread—retain perfect writing points after long, hard use.

SPENCERIAN STEEL PENS

Steel, tempering, grinding—they do it.

Sample card of 12 different styles with 2 good penholders sent for 10 cents.
SPENCERIAN PEN CO.,
349 Broadway, N.Y.

A Permanent Edge

You can keep your razor constantly keen, so it will give you a close, comfortable shave every day, if you use our

New Torrey Honing Strop

You don't need any experience or any special skill—the new strop will do it all. The sharpening side is prepared with our newly discovered sharpening dressing. This is *our secret* and no other strop in the world has it. That is why the New Torrey Strop keeps your razor in so much better condition than any other strop. If your dealer cannot show you the New Torrey Honing Strop—write us for full information. Booklet, all about shaving, sent free on request.

Prices 50c, 75c, $1.00, $1.25, $1.50, $2.00 and $2.50

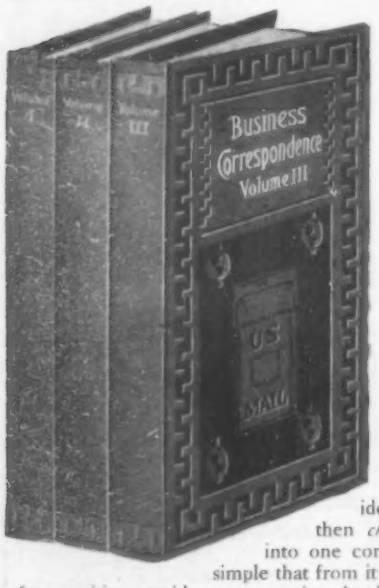
Get a Torrey Razor - the Best Made.

Every dealer who is not now selling the New Torrey Honing Strop should write at once for our special proposition.

J. R. TORREY CO., Dept. G, Worcester, Mass.

A Library of the World's Greatest Business Letters

The letters that have sold the *most* goods, collected the *most* money, settled the *hardest* complaints, won the *best* jobs, had the *strongest* influence—analyzed and dissected for *you* to learn from, to adapt to your needs, or to develop an original style of your own—with the best examples actually reproduced as they were used and graphically explained point by point.



Here in these three volumes—672 pages—are packed the success-secrets back of the letters that are actually winning the biggest results today, that are bringing orders from you and me, and making other men's fortunes.

Two years of investigation by a staff of experts employed by SYSTEM, the Magazine of Business, were spent collecting the letters of firms and individuals; investigating the actual results; analyzing the comparisons of costs and profits; studying the difference in results obtained by differences in arrangement, wording, enclosures, etc.

Every striking idea found in use by mail order house, wholesaler, manufacturer, retailer, real estate or insurance man, bank, collector, individual salesman or complaint clerk was followed out and its returns studied. This mass of information, this wealth of ideas, this gold mine of absolute fact was then *charted* and *diagrammed*—and developed into one complete, yet concise, library so clear and simple that from it any busy man can pick out for any sort of proposition, an idea or suggestion that he can *know* in advance to be successful; or can turn to for original inspiration.

It is a work that will show any man *how* to write or dictate the kind of letter that arouses attention, tingles with convincing strength, and carries its point; how to conduct a follow-up campaign, how to key results, how to compile and index names, how fit schemes and plans to any proposition.

Special Forced Edition — $1 DOWN

SYSTEM, the Magazine of Business, conducted this exhaustive investigation only for its subscribers. It was not to be given to the general public until 1912. But the subscribers' edition has caused a public knowledge of the tremendous value of the contents, and an extra advance edition has been made imperative. 2640 special sets have been hastily printed.

To make its distribution fair and equitable to all business men, SYSTEM has made the terms as simple as writing your name and as easy as buying your cigars. $1 with this coupon brings to you the complete "Business Correspondence Library"—3 volumes—672 pages, transportation prepaid. $2 per month for 4 months thereafter—less than 7 cents a day—*pays* for them complete and in addition brings you SYSTEM, the Magazine of Business, every month for two full years—24 numbers of this remarkable business magazine, including a copy of

Would You Like to See Actual Examples of How Other Successful Men Have Written—

—**Letters to Follow-Up Inquiries** see Vol. I, pp. 138, 139; Vol. III, pp. 75, 84.
—**Nine Main Angles for Follow-Up Letters** see Vol. III, pp. 63, 64, 78.
—**Letters to Accompany Catalog** see Vol. II, p. 35.
—**Opening Paragraphs to Get Attention** see Vol. I, pp. 34, 35, 36, 37, 38, 39, 84, 85.
—**Interest-Holding Paragraphs** see Vol. III, pp. 149, 150.
—**Arguments to Clinch the Sale** see Vol. I, p. 47; Vol. II, pp. 47, 136.
—**Schemes to Get New Customers** see Vol. II, pp. 169, 214, 224, 225, 227; Vol. III, pp. 29, 31, 137.
—**Money-Getting Collection Letters** see Vol. I, p. 135.
—**Clever Answers to Complaints** see Vol. III, pp. 189, 198.
—**Arguments to Advance Prices** see Vol. III, pp. 159, 161, 174.
—**Paragraphs to Prompt Action** see Vol. II, pp. 16, 17, 71, 72, 73, 74, 75, 76, 77, 78, 79; Vol. III, pp. 92, 93.
—**Letters to Dealers' Clerks** see Vol. III, p. 32.
—**Educational Letters to Dealers' Customers** see Vol. III, pp. 8, 9, 12, 13, 138.
—**Sales Letters to Dealers' Customers** see Vol. III, pp. 18, 19, 21, 22.
—**Letters to Follow-Up Real Estate Sales** see Vol. III, pp. 77, 86, 87, 88.
—**Letters to Illustrate Demonstration Offers** see Vol. III, p. 157.
—**Effective Descriptions in Letters** see Vol. I, pp. 44, 45.
—**Salesmen's Letters to Dealers** see Vol. III, pp. 41, 42, 43, 44.
—**Unusual Sales Letters** see Vol. II, p. 12.
—**Letters to Answer Specific Inquiries** see Vol. II, pp. 37, 38.
—**Clever Schemes to Get Replies** see Vol. II, pp. 22, 26, 27, 28; Vol. III, pp. 167, 168.
—**Paragraphs to Increase Effectiveness of Enclosures** see Vol. III, p. 148.
—**Business-Getting Postals** see Vol. II, p. 63.
—**Schemes to Get Line on Prospects' Needs** see Vol. III, p. 136.
—**Plans for Offering Premiums** see Vol. III, pp. 100, 175.
—**Effective Summaries** see Vol. I, p. 46.
—**Their Best-Pulling Letters** see Vol. II, pp. 108, 109.
—**Letters Emphasizing the "You" Element** see Vol. II, pp. 133, 134.
—**Special Inducements to Retailers** see Vol. II, pp. 128, 129, 141, 178.
—**Letters Emphasizing Special Prices** see Vol. I, p. 140; Vol. III, p. 158.
—**Dealer's Trade-Getting Letters** see Vol. II, pp. 186, 187, 188, 189, 190, 191, 197, 198, 205, 206, 207, 208, 211, 214, 217, 218, 219, 220, 221, 222, 226, 228; Vol. III, p. 25.
—**Trade-Getting Letters to Consumers** see Vol. II, p. 147.
—**Letters Asking Credit Information** see Vol. I, pp. 185, 186, 187.
—**Letters to Poor Credit Risks** see Vol. I, p. 187.
—**Letters Taking Reader Into Confidence** see Vol. III, p. 181.
—**"Last Resort" Collection Letters** see Vol. I, pp. 160, 164.
—**"True Note" Collection Letters** see Vol. I, pp. 190, 193, 194.
—**Retailers' Collection Letters** see Vol. I, pp. 147, 148.
—**Instalment Collection Letters** see Vol. I, pp. 154, 155.
—**Collection Letters Offering Inducement** see Vol. I, pp. 156, 157.
—**Tactful Collection Letters** see Vol. I, pp. 140, 141, 161, 162, 163, 164.
—**Collection Letters Quoting from Delinquent's Letter** see Vol. I, p. 176.
—**Letters to Bring Cash With Order** see Vol. I, pp. 189, 191.
—**Collection Letters Containing Salesmanship** see Vol. I, p. 188.
—**Letters for Collection Agencies** see Vol. I, pp. 158, 159.
—**Letters Based on Current Events** see Vol. I, pp. 90, 92, 147, 173.
—**Letters Illustrating "Man-to-Man" Attitude** see Vol. I, pp. 86, 89, 90.
—**Letters Backed With Proof** see Vol. II, p. 15.
—**Letters Backed With Inducement** see Vol. I, p. 47; Vol. II, pp. 49, 136.
—**Letters Appealing to Women** see Vol. II, pp. 87, 89, 91, 92, 93, 95, 96, 97.
—**Letters Appealing to Merchants** see Vol. I, p. 149.
—**Letters to Revive Old Customers** see Vol. III, p. 182.
—**Letters Offering Investments** see Vol. II, pp. 102, 107, 110, 111.
—**Letters Appealing to Farmers** see Vol. II, pp. 118, 119, 120.
—**Letters With Appeals That Get Attention** see Vol. II, p. 26.
—**Letters With Effective and Clever Appeal** see Vol. I, pp. 101, 103, 104; Vol. II, pp. 101, 107, 103; Vol. III, pp. 172, 178, 179.

The Big September SYSTEM

—the number that contains not only many pages of business plans and ideas and schemes, but also the biggest and most interesting advertising section of any magazine in the world. SYSTEM stands pre-eminent the Monthly Magazine of Business—260 to 356 pages in every issue and you cannot afford to miss a single one of them. SYSTEM shows you how to conduct or how to start a business, how to win trade, minimize wastes, keep down expenses, manage men—schemes and plans for increasing sales, conducting advertising and follow-up campaigns—ideas and methods for making more from your daily work. With this coupon you receive SYSTEM every month for two years and receive at once the complete new 3-volume Business Correspondence Library. Send only $1 with the coupon.

Here at last is the clear, complete, specific method by which the business manager can make his firm's letters crackle and snap with business strength—the salesman make his letters as keen and terse as his selling talk—the young man develop himself into a power with his employers—by which banker, real estate agent, insurance man, credit man, can dictate into a letter with scientific certainty the style and character that commands. Do not risk losing your chance at this advanced edition. Act today.

I enclose $1. Send me at once, transportation charges fully prepaid, the complete 3-volume "Business Correspondence Library"—672 pages—Bound in Maroon vellum, and enter my name for a full 2 years' subscription to SYSTEM, the Magazine of Business, to include the big September number. I promise to remit $2 each month for the four following months, making $9 in all. Sci. Am. 10-7

Name.....

Address.....

City and State.....

Wabash and Madison CHICAGO **SYSTEM** THE MAGAZINE OF BUSINESS 44-60 E. 23rd Street NEW YORK

NOTE.—In Canada price complete is $10. Price in foreign countries $11—$5 down, $2 per month. Communications from European countries should be addressed to A. W. Shaw Company, Ltd., 34, Norfolk, Strand, London, England.

15c a Copy

15c a Copy

AVIATION

The October Magazine Number of the Scientific American Issue of October 14th, 1911

The next mid-month number of the Scientific American will bear the date, October 14th, 1911. ¶ A large part of the number will be devoted to the more practical aspects of flying. ¶ Besides these articles on aviation, the mid-month number for October will contain the usual Scientific American material, abstracts from current periodicals, the inventor's department, and articles on recent achievements in science and industry. ¶ The whole number will be enclosed in a beautiful colored cover by Mr. Wm. H. Foster.

Please note the change of price of Magazine Numbers—now fifteen cents on all news stands

MUNN & CO., Inc., *Publishers*, 361 Broadway, New York

JUST PUBLISHED *A New and Authoritative Book*

MONOPLANES and BIPLANES

THEIR DESIGN, CONSTRUCTION & OPERATION

The Application of Aerodynamic Theory, with a Complete Description and Comparison of the Notable Types

By GROVER CLEVELAND LOENING, B.Sc., A.M., C.E.

CRITICISMS

"The first treatise upon aviation which we have seen which may be styled really complete. . . . . Actual aeroplane designing is the central theme of the volume. . . . . The prominent types are exhaustively compared. . . . . The illustrations are a notable feature."
—*Rochester, N. Y., Chronicle.*

"A very complete account of the theory of heavier than air flying machines with a technical description of nearly all the present types of aeroplanes. . . . . Presents in compact shape the substance of aerodynamic theory. . . . . Easily comprehensible to the reader who can concentrate his attention. . . . . It is the most scientific popular book on the aeroplane that we have come across so far."
—*New York Sun.*

"Many writers have failed to realize the demand which exists for aero literature in which mathematical deductions are a necessary but not predominant part of a comprehensive exposition of the entire subject. For a writer to steer a straight course between the mazes of trigonometry on the one hand, and the superficialities of mere discussion in a popular vein on the other is to accomplish what can be done only by one who is himself a thorough student in the finer details, but who can sufficiently divorce himself from the mathematical atmosphere as to present the whole subject from a broad standpoint, making it readily intelligible and informative to the less erudite seeker after knowledge."
—*Phila. Inquirer.*

"Students learned in aerodynamics and laymen ordinarily interested in aviation will find equal delight in reading 'Monoplanes and Biplanes.' The book is a welcome addition to the libraries of those who have realized the future of aerial navigation, and desire a work treating solely of the heavier than air machines written by an acknowledged expert and with no hobbies hidden in the discussion."
—*Boston Journal.*

"While enthusiastic in his interest as becomes one who has written so superb a volume, Mr. Loening is also rigidly accurate as the most exacting scientist could demand. Here is a work which is at once a history and textbook which may be depended upon for everything that is within the range of actual knowledge. To say that 'Monoplanes and Biplanes' is at once new and authoritative with reference to the entire subject and that it is practical in the highest degree is the just praise due to this volume."—*Buffalo News.*

"Mr. Loening has written, in fact, for the man who wishes to apply practically the experience that has already been gained."
—*New York Times.*

12mo. (6x8¼ inches) 340 Pages, 278 Illustrations. Attractively bound in cloth

Price $2.50 net, postpaid

An illustrated descriptive circular will be sent free on application.

MUNN & CO., *Inc.*, Publishers
361 Broadway New York